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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XLIII., No. 21. FRIDAY, NOVEMBER 22, 1907.

At a conference held in Chicago Wednesday representing 37 roads and over 1.000,000 cars a resolution was adopted approving rules providing that when a car is received from its owner in switching service, it is not to be moved out of the switching district, and must be returned to its owner. The penalty for violation was fixed at five dollars, but it was further provided that the agreement should be obligatory only at points where all roads agree and that it could be put in effect at any point where a number of roads centered. The roads opposed were those objecting to the old diversion agreement, chiefly the New York Central lines and the Southern, making practically a Chicago road agreement.

Further discussion of one highly important but still unsettled rail specification appears elsewhere in the correspondence column. The writer is a railroad officer to whom high credit is due, not only for assembling and presenting the dangerous and costly results of using bad rails, but also for recognizing that railroads separately negotiating with the makers can only in individual cases get a better product. He is a sturdy advocate of requiring a fixed percentage of discard from the top of the ingot, pending a possible improvement in the homogeneity of the ingot and has a commonsense notion that discard, based on present practice, will hasten rather than hinder the improvement of the ingot, and that the arbitrary percentage may be relaxed as progress is made.

The annual reports for the year ended June 30, 1907, of the three Hill railroads—the Great Northern, the Northern Pacific, and the Chicago, Burlington & Quincy, which last year together operated an average mileage of 20,548 miles—are reviewed in this issue of the *Railroad Gazette*. The map published with these reports is drawn from the latest official one, and is a striking picture of the territorial extent of the Hill system. In earnings, the three railroads together have now for the first time passed 200 millions. Their gross earnings last year were $208,000,000. This year the tremendous growth of the Northwest affected the Great Northern and the Northern Pacific in a new way. The 1906 year was a high record one not only in gross but in net earnings and profits after all charges. In the 1907 year the increases in gross earnings continued but the business was handled at a rapidly decreasing margin of profit, so that net earnings of the Northern Pacific were little larger than in 1906 and on the Great Northern were smaller by nearly $3,000,000 than in the previous year. Both roads have reached the point where large expenditures must be made on double tracking, cutting down grades and reducing curves in order to maintain the same proportion of profit from operation which has been received in the past. Fortunately for their stockholders, they are both supplied with funds with which to carry out these vitally necessary improvements, through the new stock issues of $60,000,000 for the Great Northern and of $93,000,000 for the Northern Pacific, subscribed for by the stockholders early in the year. If any more traffic is to be poured over these lines—and the Northwest is slow to admit that it will long suffer from industrial depression—these sums in full will be needed to fit the roads for the task which lies before them. The case of the Burlington is different. During the past six years it has been built up out of earnings to a remarkable degree, while there has been an equally remarkable development of operating efficiency. A granger road with a vast branch-line mileage, it spent nearly $1,600 a mile last year on maintenance of way, while the Chicago & North-Western and the Chicago, Milwaukee & St. Paul, which are comparable, spent from $400 to $750 less. Meanwhile its gross earnings have risen from $53,800,000 in 1907 to $82,500,000 last year. Few roads are in so strong a position as the Burlington to meet industrial depression, yet 20 or even 10 years ago few roads were so vulnerable. The showing of these three great railroads is in itself the best of proof of the past wisdom and present foresight of that great railroad manager, James J. Hill.

According to the old theory of the duties of a State Railroad Commission, the most useful function of such a body is that of an illuminator; not exactly a publicity bureau, for the matters with which it deals are in many cases accessible to the public already; but an instrumentality to make the public see things which people lack the discernment to pick out for themselves. It is encouraging to see evidence that this old theory is still alive and in the hands of competent men, who try to throw light into fields where it is needed rather than on things which mostly please the galleries. Mr. Ciark, of the Interstate Commerce Commission, set a good example in this line when he told an Ohio road how to distribute coal cars to the mines. We do not know that the plan which he laid down was exactly right; possibly a year's trial may be necessary to justify any plan of that kind; but it is good to have that troublesome subject brought out into the light, so that everybody can have authoritative knowledge concerning it. In a matter which, like the distribution of cars when cars are scarce, the railroad manager cannot possibly handle to the satisfaction of everybody, managers ought to be glad to let the government step in. The Indiana commission

has adopted Mr. Clark's rule, in substance, for one road in that state. The commissioners may not have a pleasant task in justifying their rule, if shippers who are short of cars make complaint, but it ought to be much pleasanter for them than for the railroad manager, for they are looked upon as the avowed friends of all shippers. The demand for a uniform classification of freight is another matter which a commission can deal with much better than can railroad managers. If, as all experts have long believed, the scheme is unworkable, it is highly desirable that a government body declare the fact. If, on the other hand, the thing can be accomplished, it will be only by arbitrary raising or lowering of a great many rates; and only a governmental body, with its unparalleled inertia to resist disturbers, should take such arbitrary action. We do not say that the government ought to decree uniformity, but it is quite plain that the railroads ought not to. The only way to do it is by leveling down or leveling up; but the first would be unjust to the railroads and the second would be intolerable to the shippers.

The Albany Commission—New York State Public Service Commission, Second District, is an intolerably long name—has announced plans for desirable publicity in three important matters—freight movement (embargoes and car shortage), passenger movement (in one feature, engine failures), and permanent improvements. The public is entitled to accurate knowledge on these matters, but has to put up with what the newspapers can get. Usually the reader gets fragmentary material prepared by poorly qualified reporters. Embargoes have lately had to be declared against apples and vegetables at Pittsburgh and Cleveland, against grain at Buffalo and Galveston, and on various commodities at several other places. An embargo has great possibilities of injustice, and a statement of the facts in any given case from an impartial state authority ought to be a benefit to the railroads. The New York Board's call for records of engine failures is significant mainly because the Board has engaged an experienced locomotive superintendent to receive and digest the reports, instead of entrusting the matter to an amateur, as has been done with many subjects in many states. Indeed, this last is an essential feature in all these publicity movements. A competent editor is an important man in a state commission. It is the disposition, already shown at Albany, to fairly use and temperately set forth the facts gathered from the railroads, which gives to the Commission's action such a hopeful look. To digest the reports of permanent improvements which the railroads have made will perhaps be the most difficult task of all, and show the quality of the Commission in this respect. The large railroads have spent enormous sums of money and probably without exception have aimed to use their resources for the best interest of the public. If the Commission finds this to be the fact it will, of course, put its finding on record, while at the same time it is bound to report cases of money ill-spent and also those where the public really needs more than a railroad can or will furnish. In contrast with the sane acts of the New York Commission, the reader will be interested in an order recently issued by the Railroad Commission of Missouri, which had to be suspended before it went into effect. According to a St. Louis paper "the Board on November 12 decided to suspend the greatly reduced rates on coal, which had been ordered to go into effect November 15, because their enforcement would have resulted in closing many of the coal mines in Missouri, throwing thousands of miners out of employment and affecting some of the manufacturers who have cheap rates on coal for industrial purposes. The coal operators informed the Commission that operators in Iowa and Illinois could ship their coal to St. Louis and Hannibal and reconsign from those points and thus take advantage of the low rates in Missouri. Coal may be mined so cheaply in Illinois and Iowa, as compared with the cost of mining in Missouri, that such a reduction in rates would make the Illinois and Iowa operators dangerous competitors in the Missouri market."

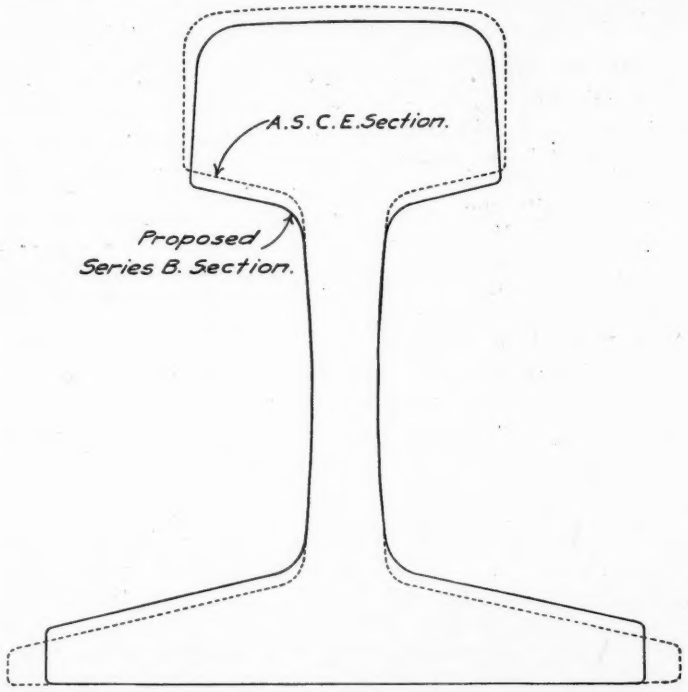
SETTLEMENT OF THREATENED BRITISH STRIKE.

On November 6, a King's messenger traveled by special train and motor to Sandringham to tell His Majesty that the railroad crisis was at an end. The happy result is due in the first place to the skill and efforts of the President of the Board of Trade, but that his efforts were so rapidly brought to a satisfactory conclusion is doubtless the result of the firm attitude maintained by the companies up to the very last, on the question of recognition. While willing to make every concession in the interests of industrial peace which their duty to their shareholders justified, they refused to the last to allow the interference in management which this would inevitably have entailed. The solution now reached does not include recognition of the unions, and, in consequence, does not meet with any warm welcome from the other trade unions in the country. For while in the agreement recently made with the Amalgamated Engineers' Society any employee had the option of going straight to his union, the railroad employee now can only take the matter to the Conciliation Board after it has been put before his employers.

But although the companies were unable to accede to the request of the unions for recognition, they have shown themselves quite ready to modify the present system for the removal of disputes, and to extend the means for bringing about the peaceful settlement of questions relating to hours and wages, to the consideration of which, it will be noted, the Conciliation Boards are limited by the agreement. Briefly, the arrangement arrived at is this. Boards are to be appointed for each railroad company to deal with questions of hours or wages referred to them by employers or employed, after such questions have failed to be settled by the means at present in vogue. The union officials, as such, have no *locus standi* in the earlier stages of the dispute. If, however, they are employees, they may of course be elected members of the conciliation boards, or they may appear before them to represent the men before the boards, for neither solicitors nor barristers will, wisely we think, be allowed to appear. The various grades and the various districts will be separately dealt with, the boards will have two chairmen elected by the two sides, and the two sides will vote separately and subsequently agree. Nominations for the boards are to be submitted to and approved by the Board of Trade. The term of each board will be three years, but the present agreement is to last seven years. In the event of either masters or men failing to accept the decision of the board, the matter may, on the motion of either party, be referred to a Central Conciliation Board. Failing agreement again, the matter goes to arbitration. As the law now stands, there is nothing of course to compel the union to abide by the decision of the arbitrator. But in Great Britain public opinion would be a weighty factor in the matter, and in any case legislation making the arbitrator's award compulsory, could and probably would, if necessary, be resorted to.

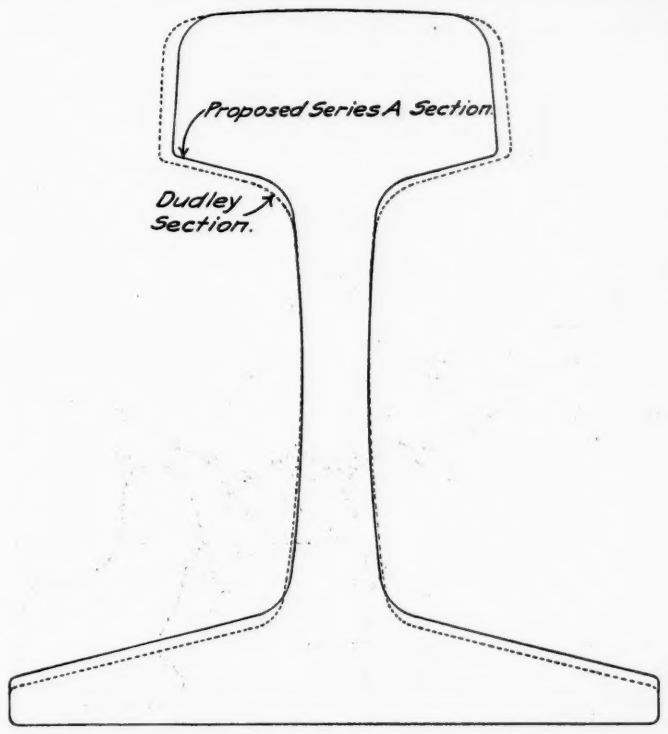
TWO TYPES OF RAIL SECTIONS.

The two types of rail sections proposed by the Rail Committee of the American Railway Association represent two different ideas in rail design, while at the same time both approximate the requirement that the metal be equally distributed in the head and base. The origin of the two sections is not hard to trace. Series A is a modification of the Dudley section used on the New York Central,



and Series B is a redesigned A. S. C. E. standard section. In the accompanying engravings the original and modified sections have been superimposed on each other to show geographically the changes proposed. In the Series A section metal has been taken from the sides and bottom of the head of the Dudley section and added to the

top of the base. The web has been thickened 1/64 in., but otherwise no change has been made. P. H. Dudley has long been an advocate of a rail section designed as a stiff girder, and approximately the same vertical strength has been retained in the Series A section with some sacrifice in the amount of metal which can be worn off of the head. The Series B section has a slightly better distribution of metal than the Series A section. It meets the requirements where the wear of metal in the rail head is a matter of more serious consideration than additional strength as a beam. No sacrifice in the depth of the head has been made over the A. S. C. E. section, and only a small decrease has been made in the width of the head. Such metal as has been taken from the head has been added to the thickness of the base, which is also increased by reducing the width of the base from 5¾ in. to 5⅛ in. in the 100-lb. section. The stiffness has been reduced also from a moment of inertia of 44.4 to a moment of 41.3, or 7 per cent. The relative distribution of metal and moment of inertia of 100-lb. rails of the four sections is given in the following table:



	Distribution of metal in per cent.			Moment of inertia of
	Head.	Web.	Base.	100-lb. section.
Am. Railway Assoc., Series A.....	36.9	23.4	39.7	48.94
P. H. Dudley—N. Y. Central lines...	40.8	23.5	35.7	48.5
Am. Railway Asoc., Series B.....	40.2	19.2	40.6	41.3
Am. Society of Civil Engineers	42.0	21.0	37.0	44.4

The superimposed outlines of 100-lb. sections are shown here simply to indicate the changes graphically. In other pages are shown the proposed sections and data for rails of different weights.

SMOKE ABATEMENT ON RAILROADS

Nowadays it is generally admitted that the smoke from soft coal in thickly settled districts is a decided nuisance, and an unnecessary nuisance at that. Attention has been directed to the large stacks of power plants and factories and the unpleasant effects of the volumes of smoke and soot which pour from them and over the surrounding country.

In many localities the smoke from locomotive engines is more annoying than that from stationary plants. The constant passing to and fro of the locomotives distributes the smoke over a large area and the low level of the stacks causes most of the smoke to linger near the ground. In the neighborhood of union stations and of railroad yards in our large cities this is especially noticeable. The southern part of Chicago, the lake front in Cleveland and the neighborhood of the university in Philadelphia are striking examples.

The conditions on a locomotive are particularly trying, and there are many difficulties which are absent in the stationary plant. The engineer in the latter usually grumbles if the load varies 25 or 50 per cent. and complains that he cannot keep his fires in good condition. If the grade of coal is changed two or three times in a season, he considers himself a much-abused man. The locomotive engineer, on the other hand, finds his load increased in a few minutes from nothing to 25 per cent. overload, and is fortunate if he can have the same grade of coal on two successive days. In yard service the conditions are oftentimes particularly trying, and the fireman has enough to do to keep his engine moving without giving much thought to careful firing. Starting a heavy passenger train from the station with a new fire, taking a through freight over bad grades and curves inside the city limits, or starting any train when the rails are slippery, gives the engine crew enough to think of beside smoke abatement. However, "nothing is so bad that it may not be better," and there is a trace of silver even in the smoke cloud.

Perhaps the first thing which should receive attention is the quality of fuel supplied to the engine. Different coals require different treatment and different methods of firing. No fireman can expect to get good results when he has to change without notice from one grade to another. The coal should not only be of good quality and uniform in its characteristics, but should be so prepared before reaching the tender as to be of the right size for firing. It is a waste of a good fireman's time to ask him to break coal at the engine. Locomotives will probably be stoked by hand for the present, as so far no mechanical device has met with general adoption or approval. The adoption by several roads of rules for firing on the "single scoop" plan has resulted in a marked reduction of the amount of smoke. These rules vary somewhat on the different lines, but may be summarized as follows:

One shovelful to be fired at a time and the door left slightly ajar for a few seconds, but no longer than is necessary to burn the gases. The fire to be kept as light as possible. In starting, the blower to be put on, and after a sufficient supply of coal has been shoveled for a good fire the door to be left open an inch or so until all smoke disappears, when the door is to be closed.

Water to be supplied to the engine continuously when possible and the engineer and fireman to work together for uniform conditions.

Blower to be used when approaching a station and on down grades.

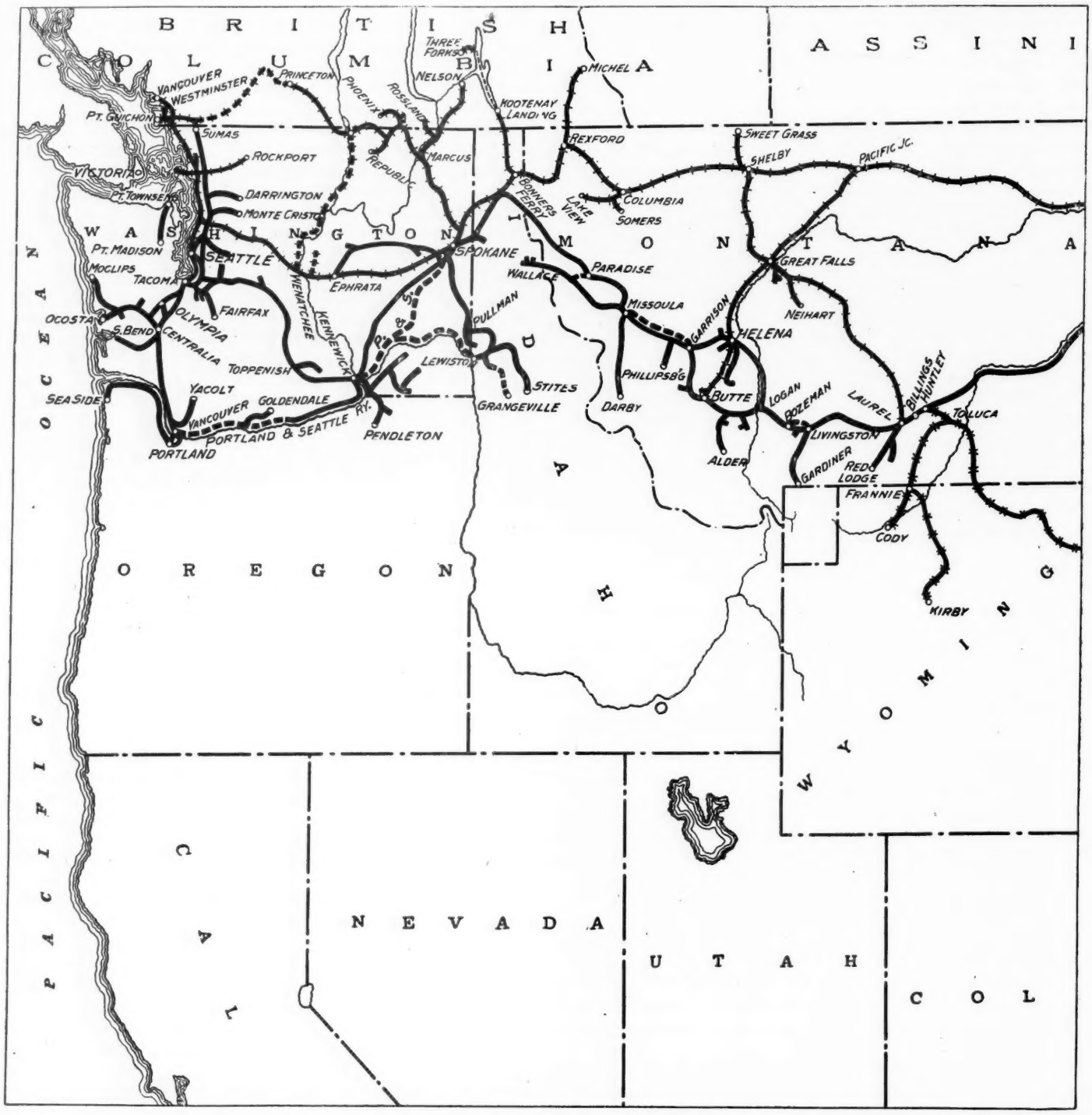
Doors not to be left open except as herein noted.

Attention to such rules has reduced the amount of smoke emitted more than 50 per cent. in several cases which have come to our notice. The brick arch is an efficient smoke abater, as it helps to burn the gases and to prevent their being chilled by striking too soon on the tube sheets. A deflector plate above the fire door, which shall direct downward the currents of cool air entering the door, is another useful adjunct. If the plate burns away the expense of renewal is not great, while it is possible to protect it with firebrick if necessary. If steam jets are used, they should be located just above the door on either side. Two-inch steel tubes can be inserted through both plates and expanded in the usual way. The steam jets can be directed through the openings thus provided and pointed in the way which shall be most effective. It would seem that some automatic apparatus of the door-check type might be used to advantage in operating both fire door and steam jets. A dash pot could be so arranged as to rise by the action of opening the fire door and to turn on the steam jets. It could then be set so as to close the door and shut off the steam after a proper time had elapsed.

But no mechanical apparatus or devices for abating smoke can take the place of care and intelligent co-operation on the part of both engineer and fireman. There must be a thorough understanding between the two, so that the fireman may not have unexpected demands for steam, but may know for a reasonable time beforehand what is to be expected of him. The engineer should use all the means in his power to make the conditions of firing as uniform as possible and to prepare in season for any unusual fluctuations of service. Engineers and firemen are human, like the rest of us, and the exigencies of train service are such as to turn their thoughts entirely away from any such æsthetic subject as smoke abatement. The experience of those who have dealt with this problem in the neighborhood of our large cities has shown it to be necessary to institute a careful system of inspection of all locomotives inside the city limits, and especially of those used in yard service. Every supervising engineer or chief smoke inspector should have in his employ a sufficient number of subordinates for this work, who are themselves trained railroad men, capable of appreciating the trials of the engineer and firemen and of making allowance for necessary infractions of the rules. Careful and systematic observation of each locomotive as long as it is in sight of the inspector, with a grading of the smoke density on a ruled chart prepared for the purpose, will enable the inspector to speak with knowledge which will command respect. These smoke charts can easily be made in duplicate by the use of carbon paper and one copy sent to the railroad office, the other being retained for reference. Comments written on the charts will express the opinion of the inspector as to whether the smoke observed was necessary or unnecessary. In most cases the officials of the railroads have been glad to co-operate with the inspectors in this work and to call upon the carpet employees who are manifestly careless or inefficient in this regard. It is perhaps needless to say that

the improvement in smoke conditions obtained in this way will also mean an improvement in the efficiency of the locomotive and in the condition of the firebox and flues. In fact, some roads have found it advisable to enforce some such rules as these throughout their lines merely as a matter of economical firing. Until such time as some suitable mechanical apparatus shall have been devised for this purpose, reliance will have to be placed on the means just outlined.

The question of the use of smokeless fuels is to a large extent a local one. The use of either Pocahontas coal or coke involves certain changes in the firebox and grates which make it decidedly inconvenient to change from the use of these fuels inside the city limits to the use of soft coal on the lines. In many cases, however, fuels of this kind can be used for switching service with good results, and it may be possible to change engines at the yard limits and employ smokeless fuel within the confines of the city. Without doubt, the electric locomotive will take every year a more prominent place for interurban service and for most of the work in the neighborhood of large cities. The ordinary soft coal-burning engine is, however, destined to be with us for a considerable period, and the importance to the community at large and the railroads themselves of reducing the consequent smoke cannot be stated too strongly.



The Hill Railroads—Western Section.

Great Northern.

The Great Northern is the railroad which J. J. Hill created and which he himself has managed. Therefore it reflects both the high standard of railroad construction originally carried out and the operating methods continuously applied over many years which made this railroad builder again famous long after his road was put through to the Pacific coast.

To the Great Northern, the past year has brought many changes. The annual report for 1906 was reviewed in the *Railroad Gazette* of November 16, 1906. On that day Great Northern stock sold at 330. In December, 1906, each shareholder was given as many certificates of beneficial interest in the company's ore properties as he held shares of stock. These ore certificates sold for about 85 at the time of their issue and are selling at about 40 to-day. On December 11, 1906, an increase of $60,000,000 in the capital stock was authorized and offered to stockholders at par, with payments in instalments running up to May 1, 1908. The rights to this new issue were quoted at about 35 when it was announced. The high price at which Great Northern stock was selling last fall was due in large degree to the expectation of these valuable distributions to stockholders. Furthermore, the road had just had the largest earnings and most prosperous year in its history. Now Great Northern stock sells around 110.

This tremendous decline in price is due to a number of different

influences. In the first place there is no expectation now of valuable rights in the near future; in the second place, there has been a tremendous drop in the prices of all securities; in the third place, though gross earnings have again increased, the Great Northern has been very hard hit by increases in operating expenses. With gross earnings about $4,000,000 larger than in 1906, net earnings last year were nearly $3,000,000 less.

Like all other roads the Great Northern suffered from increases in wages and in the cost of material and supplies. There were two other special influences which reduced its net earnings, from which it suffered more than most other roads. These were a large number of rate reductions, voluntary and forced, and a very severe winter during which the depth of snow in northern Minnesota and North Dakota was greater than ever known since the line was built. The severity of the weather increased the demand in these districts for fuel at the same time that it made it almost impossible to keep the railroad lines open. Some towns ran out of fuel altogether and for a week or two were in desperate straits. Fuel and supplies had to be moved to save lives whether other traffic moved or not. This caused a direct and unusual expenditure of over $950,000, which does not include the loss of earnings due to delays and suspension of the movement of traffic.

The various rate reductions caused an actual loss in earnings of about $1,000,000. They are important enough to be listed in detail, as follows:

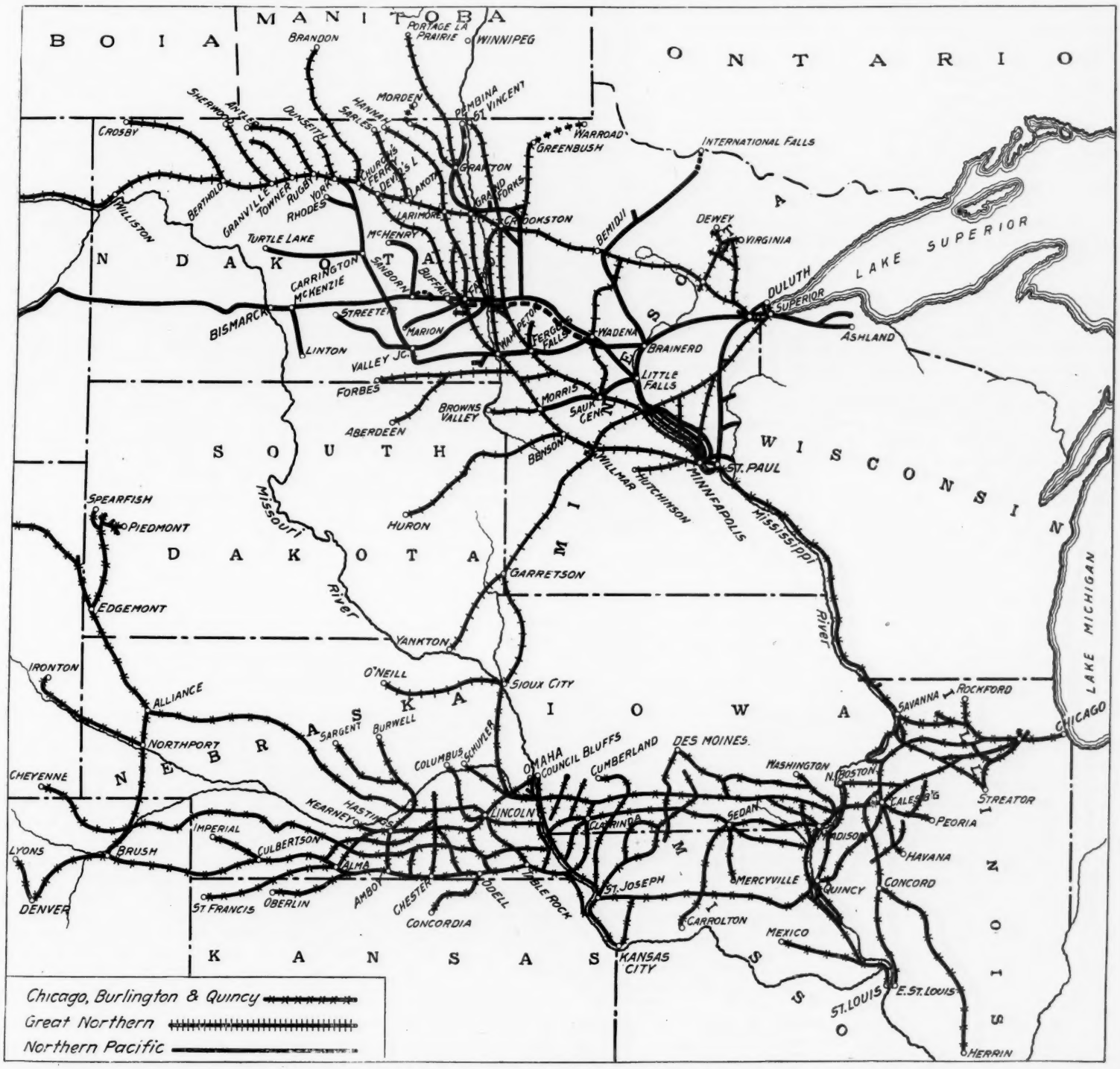
On Sept. 1, 1906, grain rates from stations in Minnesota, North and South Dakota, Iowa and Nebraska were reduced, causing a loss of revenue for the ten months of $400,000.

On Sept. 10, 1906, a reduction of about 10 per cent. in class rates was made from far Western points to Montana points.

On Oct. 22, 1906, rates on coal from Duluth, St. Paul and Minneapolis, Minn., and Superior, Wis., to stations in Minnesota, North and South Dakota, Iowa and Nebraska were reduced, causing a loss up to June 30, 1907, of $50,000.

On Nov. 15, 1906, reductions were ordered by the Minnesota Railroad and Warehouse Commission on merchandise shipped between local points in Minnesota. As a result, reductions had to be made in interstate rates so as to grade out the Minnesota rates in the bordering states. During the 7½ months in which these rates were in effect the Great Northern's revenue was reduced $317,000, or at the rate of over $500,000 a year.

On Dec. 12, 1906, a new distance tariff with rates about 10 per cent.



The Hill Railroads—Eastern Section.

On March 11, 1907, on the opening of the line north to Portage la Prairie, Man. (the line to Brandon, Man., was opened April 4, 1907), the rates from Port Arthur to Manitoba points were applied to shipments from Duluth and eastern terminals to points in Manitoba reached over either of these new lines. This, however, was a rate reduction made necessary in order to compete with the Canadian Pacific and the Canadian Northern, which both use the Port Arthur gateway.

On March 18, 1907, new rates ordered by the South Dakota Railroad Commission went in effect. These reduced by about 10 per cent. the rates on live stock and traffic shipped on class rates.

On June 3, 1907, new rates ordered by the Minnesota Railroad and Warehouse Commission on various staples in carloads from Eastern terminals to 11 lower than before, went in effect between points in Washington and in Idaho, and between points in those states and stations east.

different jobbing centers became effective. The average reduction under this order amounted to about 14 per cent.

On June 1, 1907, maximum freight rates on grain, coal, lumber, live stock, and other commodities, were to have taken effect. The Great Northern prepared new tariffs in accordance with these rates, but on May 31, 1901, on the prayer of certain stockholders, the United States Circuit Court in Minnesota granted an injunction to remain in force until suit was decided, forbidding the company to adopt the rates on the ground that they were unreasonably low and confiscatory. This suit has not yet been decided.

These reductions, it will be observed, are all of freight rates. Freight earnings are a railroad's strong dependence, and thus far few railroads have had any serious reductions by law in their freight rates. The Great Northern has been peculiarly unfortunate in this respect.

Nor has it been free from passenger-rate reductions. By legislative act passenger rates were reduced from 3 to 2 cents a mile in Nebraska, effective March 6, 1907; in Minnesota, effective March 6, 1907; in Iowa, effective July 4, 1907, and in Wisconsin, effective August 15, 1907. Passenger rates were reduced from 3 to 2½ cents a mile in North Dakota, effective July 1, 1907, and in South Dakota, effective August 15, 1907. President L. W. Hill (James J. Hill being now Chairman of the Board) states that the minimum reduction in the Great Northern's revenue by reason of these passenger-rate reductions, based on the passenger business handled this year, will amount to $1,180,000 a year. It is therefore evident that the Great Northern has been and will probably be in the year now passing a heavy sufferer from enforced rate reductions.

The increase in operating expenses was $6,700,000, or 26 per cent. Maintenance of way increased 24 per cent., maintenance of equipment 17 per cent. and conducting transportation $4,160,000, or 33 per cent. Of this last increase $799,000 came from "station service," due to more stations, increase in station forces and higher rates of pay. In the past the Great Northern has been accused of maintaining stations only where it wished to do so, and the large increase in this item, especially as it was stated in the 1906 report that part of the increased expenses of that year came from the opening of additional stations, looks as though the road had been compelled to follow a more liberal policy in this respect. There was an increase of $373,000 in "train service," due to additional train mileage and increased wages. "Engine service" increased $1,745,000, due to 12 per cent. more engine mileage, an increase of $550,000 in wages of enginemen, an increase of $75,000 in cost of "other supplies," and an increase amounting to $1,020,000 in the cost of coal, of which there were about 300,000 more tons used than in 1906.

These are the only detailed figures given in regard to any of the three great operating expense accounts. As a consequence, no unit maintenance of equipment figures can be worked out. Maintenance of way, however, cost $1,342 a mile, against $1,093 in 1906 and $973 in 1905. The 1907 increase in this figure is an important one and raises the standard of the road in maintenance of way per mile to a figure which, if the road has been so well maintained on so much less during previous years, ought to be more than adequate for keeping up the condition of the property.

There was more traffic throughout the year than could be conveniently handled, an underlying factor which counted for a great deal in increasing the operating cost. The trainload was increased, but at the expense of the helping mileage. The Great Northern, with its nearly 6,000 miles of line and its many branches and feeders, carries an average revenue trainload of 549 tons. This is an increase of 3½ per cent. over 1906, when the revenue trainload was 530 tons. Including company freight the trainload was 625 tons, against 590 tons in 1906. As remarked in the review of the 1906 report, Mr. Hill's average trainload on his pet property has long been, and still continues to be, the marvel and the despair of other railroad managers. The increase in total trainload was 6 per cent.; the increase in freight and mixed train mileage 5 per cent. Against these the mileage of locomotives employed in helping freight and mixed trains increased 30 per cent., following an increase of 32 per cent. in 1906. Furthermore, the mileage of locomotives helping passenger trains increased 45½ per cent., following an increase of 113 per cent. in 1906.

These figures in themselves are enough to justify the new stock issue of December 11, 1906. Traffic has grown so great that the existing line, strikingly efficient as it always has been, is outgrown. Grades must be reduced, curves straightened and double track laid or each new increase of traffic will return a smaller proportion of net earnings than the one before. It is true that one result of the new stock issue has been to depress the market value of Great Northern stock, but the road now has funds assured for carrying out these necessary improvements. Such expenditures are not doubtful investments, but outlays necessary to maintain operating profits.

Construction advances during the year to various companies amounted to $23,314,945. For new equipment $6,000,000 was paid. Out of earnings $3,000,000 was credited to "fund for replacement of equipment" on account of depreciation of equipment caused by its use during the year. At the same time there was $2,000,000 appropriated out of income to "fund for permanent improvements and renewals" to provide for future contingencies and the cost of such additions and improvements as cannot properly be included in operating expenses, but which on the other hand should not be capitalized. There was charged against this fund during the year $4,000,000. These several expenditures suggest the large increase in equipment during the year (there were 943 locomotives on June 30, 1907, against 786 a year earlier, an increase of 20 per cent.), the various improvements to the property, and the construction of new lines to develop new territory and facilitate operation. Of the lines built for the last purpose there are two most important: The connecting line from a point near Great Falls, Mont., southeast to Laurel, on the Northern Pacific, which is to be a short connection between the Burlington through line to Huntley, Mont., and the Great Northern; and the Portland & Seattle, which is described in the Northern Pacific review, below. The most important construction work done during the year is listed in this week's Railroad Construction column.

The following figures of mileage, earnings and operating expenses cover the Great Northern system, not including the Spokane Falls & Northern lines, 390 miles, which are operated separately. The figures for net income, improvement appropriations and final surplus are those of the Great Northern Railway proper:

	1907.	1906.
Mileage worked	5,982	5,906
Passenger earnings	$10,605,598	$9,460,659
Freight earnings	41,270,192	39,044,732
Gross earnings	55,144,402	51,276,280
Maint. way and structures.	8,024,889	6,453,240
Maint. of equipment	5,622,513	4,820,650
Conducting transportation.	16,833,854	12,676,737
Operating expenses	32,562,776	25,852,923
Net earnings	22,581,626	25,423,357
Net income	17,897,824	19,464,000
Improvement appropriations	4,934,976	5,130,910
Year's surplus	2,155,703	5,184,569

Northern Pacific.

The Northern Pacific came formally into the Hill system as a result of the famous Northern Pacific corner. When the Northern Securities Company was broken up by the government, control of the Northern Pacific was handed over to the Hill party, while the Union Pacific in return for almost a majority of Northern Pacific stock which it turned over to the Northern Securities Company, was given merely its pro rata share of the Northern Pacific stock held by the Northern Securities Company, which amounted to much less than a majority. The difference in value was made up by receiving its pro rata share of the Great Northern stock held by the Northern Securities Company.

In 1896 the Northern Pacific was in the hands of a receiver. Its career since the formation of the new company, with J. P. Morgan as the leading spirit, has been a brilliant one. It has profited from the tremendous prosperity of the Northwest in a remarkable degree. At the same time it has been improved not only on capital account, but out of income. Up to June 30, 1906, there had been spent out of income for additions and betterments $18,162,598. A new policy was last year adopted in regard to these improvement expenditures. This sum was transferred to capital account and at the same time added to the profit and loss credit balance. This is improving on the Chicago & North-Western's example of stopping appropriations for additions and betterments out of current income. The Northern Pacific has not only stopped making these appropriations out of earnings but has capitalized all such expenditures which have been made in the past. Probably the reason for this is that the company, believing that the value of its property is at least as great as the total amount charged to capital account and spent out of income, wishes to put itself in a better light for a possible valuation by the states or the national government. This change is really one of accounting rather than of general policy. The present management has made improvement appropriations out of income in every previous year in which it has been in control of the road. It is certain that the improvements will go on, though charged in a different way.

The Northern Pacific had the same difficulties to contend with last year as the Great Northern, but judging by results did not suffer so severely. It shows a small increase in net earnings instead of a large decrease. More detailed facts are given in regard to the severity of the winter. From November 18, 1906, to March 18, 1907, four months, the movement of all business both on the main line and branches in Minnesota, North Dakota and Montana was seriously affected by snow and cold weather. Train movement was greatly interfered with for about 100 days during this period; for over 60 days in North Dakota there was scarcely any freight moved, except fuel and supplies sent through behind snow plows. In Washington during part of the same period, that is between November 13, 1906, and February 23, 1907, the Northern Pacific suffered from serious washouts which stopped through train service between Spokane and Puget Sound and Portland for a total of 25 days. Besides this, during much of the winter the snow and bad track on this part of the railroad made the movement of trains very difficult.

The capacity of the road was overtaxed by the volume of busi-

ness at various points. The Northern Pacific had literally more traffic than it could carry, and much more than it could carry economically and expeditiously. It shows this in the same way as the Great Northern. The revenue trainload increased slightly, from 400 to 407 tons, the total trainload more, from 468 to 492 tons, and the empty freight-car mileage decreased by over 26 per cent. With an increase of 5 per cent. in revenue ton mileage, the mileage of revenue freight and mixed trains increased 3 per cent. But there are other results which spell congestion of traffic rather than economy in operation. The mileage of locomotives employed in helping mixed and freight trains increased 35½ per cent., following an increase of 33 per cent. in 1906. With an increase of 11 per cent. in mileage of revenue passenger trains the passenger locomotive helping mileage increased 31 per cent., following an increase of 59 per cent. in 1906. Within two years the passenger helping mileage has increased from 3 per cent. to 5 per cent. of the total revenue passenger train mileage, and the freight helping mileage from 13 per cent. to 21 per cent. of the total revenue freight train mileage. Here is convincing proof that the road's traffic has outgrown its economical capacity. Here also is good reason for the new stock issue authorized January 7, 1907.

Of the authorized issue of $95,000,000, $93,000,000 was subscribed for by stockholders at par, payments to be made in instalments up to January, 1909. A year ago to-day Northern Pacific was selling at 225. This month it has been down almost to par. Of course, the new stock issue is responsible for much of this decline but, nevertheless, the stockholders of the Northern Pacific are fortunate that their company for the next few years will have funds at its command to make the improvements which are vitally necessary to maintaining the maximum rate of profit on its fast growing business.

Already during the past year there have been large expenditures for improving the property. There appear to have been more improvements to the line than on the Great Northern, but this is no proof that the Great Northern is falling behind its southern neighbor and ally in the condition of its railroad. The Northern Pacific was built as most other railroads were built, by speculative methods. It has been said, perhaps unfairly, "The Great Northern was built to carry freight; the Northern Pacific, to carry bonds." At any rate, the Northern Pacific needs grade revisions and line changes where the Great Northern does not and never has needed them. There are listed in the Northern Pacific report 20 distinct pieces of double tracking, grade revisions and line changes; two in Wisconsin, four each in Minnesota and North Dakota, eight in Montana and two in Washington. The most important of these are in Montana, where work is now under way on a total of 157 miles. Besides this, one grade revision in that state, 1.75 miles long, has lately been finished. The most important of these improvements were listed in the *Railroad Gazette* of November 1, 1907, in the Railroad Construction column. How much work they really represent can be judged from the fact that on the important pieces of work under construction during the 1907 year there were 10,900,000 cu. yds. of material moved, of which 8,000,000 cu. yds. were earth, 1,200,000 hard pan and 1,700,000 rock.

The same figures are given for the work done on the Portland & Seattle, the low-grade line along the north bank of the Columbia river from Pasco, Wash., to Portland, Ore. In contrast they are mute testimony of the difficulty of the work on the new low-grade connection. During the year there were 12,500,000 cu. yds. of material moved on the Portland & Seattle, of which 3,200,000 were earth, 4,000,000 hard pan and 5,300,000 rock. On the Northern Pacific construction work there were over twice as many cubic yards of earth moved as of the two harder materials. On the Portland & Seattle there was nearly twice as much rock alone moved as earth, and rock and hard pan together made up more than three times as many yards as the earth moved.

Naturally the amounts spent during the year on the Portland & Seattle have been large. On June 30, 1906, the Northern Pacific had advanced $5,600,000 to that road for construction. During last year it made additional advances amounting to $11,400,000. Up to June 30, 1907, the Great Northern had made advances on account of the Portland & Seattle amounting to $9,200,000, making a total expenditure by both roads up to June 30, 1907, of $26,200,000. The Portland & Seattle line between Kennewick, Wash., and Vancouver, 221 miles, is rapidly approaching completion, and track should be laid by 1908. The large bridges over the Columbia and the Willamette rivers between Vancouver and Portland are well under way and to be finished by June, 1908. Then the through low-grade connection for the Northern Pacific from Pasco, Wash., to Portland, Ore., will be finished. The Portland & Seattle is also building a line from Pasco northeast to Spokane, 145 miles, which will connect it with the Great Northern. This is to be finished next summer. It is also building a branch from a connection with this Spokane line east to Texas Ferry, 41 miles, which also is to be finished in the summer of 1908. The Portland & Seattle lines are shown on the accompanying map.

This is to connect the joint lines which are being built by the Northern Pacific and the Union Pacific together between Texas Ferry and Lewiston, Idaho, 72 miles, and between Culdusac, Idaho, and Grangeville, 55 miles. The Lewiston line is being built by the Union Pacific and is mostly finished, but the bridge over the Snake river at Lewiston will not be finished until next month or later. The line to Grangeville, which is an extension of an existing Northern Pacific branch, is being built by the Northern Pacific. On June 30, 1907, when 80 per cent. of the construction work was finished, the Northern Pacific had advanced for construction of this road $2,234,379. It is expected that this extension will be finished by January 1, 1908.

The new projects and revisions of line already mentioned do not include all the improvement activities of the Northern Pacific during the past year. There were 480 miles of track laid or relaid with new 85-lb. rail, against 168 miles in 1906. On the main line 1,162,753 ties were renewed, against 946,087 in 1906. There were five miles of timber bridges replaced by permanent structures and embankments, against two miles in 1906, and 340 timber culverts replaced by stone, iron or tile, against 177 in 1906. On June 30, 1907, the company owned 250 more locomotives than a year earlier, 85 more passenger-train cars and 6,223 more freight cars. In addition there were to be received between June 30 and December 31, 1907, 52 new locomotives, 28 new passenger-train cars and 1,537 new freight cars. The increase during the last fiscal year in locomotives amounts to 25 per cent. in number and 34 per cent. in total weight on drivers, and in freight cars to 17 per cent. in number and 26 per cent. in capacity.

Gross earnings were $68,500,000, an increase of $7,300,000, or 12 per cent. over 1906. Operating expenses were $6,600,000, or 21 per cent. larger, leaving net earnings of $30,900,000, against $30,100,000 in 1906, an increase of $740,000, or 2 per cent.. The operating ratio was 55 per cent., against 50.8 per cent. in 1906. From the net income $5,926,753 was appropriated for depreciation of equipment and written off from the capital account "equipment." This charge, which compares with an appropriation of $2,000,000 in 1906, was arrived at by computing the depreciation to June 30, 1907, of all equipment owned on September 1, 1896, and purchased and built since then. The equipment account of the company is stated to represent the fair value of all equipment owned on June 30, 1907, after making full allowance for depreciation according to the principles laid down by the Interstate Commerce Commission. As already mentioned, no appropriation was made out of income for additions and betterments. The extra amount shown in the table at the end of this review, as appropriated in 1906, was $1,081,980 for the insurance fund. The surplus of the year was $6,700,000, against $8,600,000 in 1906.

Freight earnings increased 10 per cent., while the revenue ton miles increased only 5 per cent. The gain in earnings was due to a larger rate per ton-mile which resulted from a greater proportion of high-class tonnage and a shorter average haul, and not to an increase in rates. The same thing was true in the passenger department, where the rate per passenger-mile increased 8 per cent. The lower rate for 1906 was due to the large amount of low-rate traffic to the Portland Exposition; there has been no actual increase in passenger rates. It is a striking indication of the prosperity of the Northwest that, compared with 1906, the year of the Portland Exposition travel, passenger earnings of the Northern Pacific increased 18 per cent.

The great increase in operating expenses was in conducting transportation, which rose 33⅓ per cent. Maintenance of way increased 18 per cent., while maintenance of equipment decreased 7 per cent. As in the case of the Great Northern, no detailed figures of operating expenses are given, so that the increases in the conducting transportation accounts cannot be located nor the unit maintenance of equipment charges discovered. Per mile of road, maintenance of way cost $1,680, against $1,387 in 1906, and $1,382 in 1905, a distinctly higher standard of maintenance expenditure and one which represents more than necessary requirements.

The income account for the last two years is shown below:

	1907.	1906.
Mileage worked	5,444	5,401
Passenger earnings	$16,924,188	$14,368,221
Freight earnings	48,395,878	44,041,467
Gross earnings	65,534,832	61,223,476
Maint. way and structures	9,145,547	7,493,729
Maint. of equipment	5,542,209	5,944,119
Conducting transportation	20,887,730	15,673,348
Operating expenses	37,664,317	31,095,432
Net earnings	30,870,516	30,128,043
Net income	23,473,929	22,487,740
Improvement appropriations	3,926,753	3,081,980*
Year's surplus	6,697,176	8,555,760

*There was an additional improvement appropriation of $3,000,000 in 1906 for additions to and betterments of existing lines, but this has since been transferred to capital account and therefore is shown, not in this figure, but in the year's surplus.

Chicago, Burlington & Quincy.

Last and greatest of the Hill roads is the Chicago, Burlington & Quincy. It was in 1900 that Mr. Hill set out to buy a Chicago connection for the Great Northern, which he owned, and the Northern Pacific, in which he was interested. He tried in the open market to buy control of the Chicago, Milwaukee & St. Paul and failed. Nothing daunted, he took the Burlington, which connected with the Great Northern only at St. Paul and with the Northern Pacific

only at St. Paul and at one point in Montana, with most of its nearly 8,000 miles of line hundreds of miles away from either of the northern trans-continental roads. During 1900 Burlington stock fluctuated between 120 and 144. Mr. Hill paid $200 a share for it. He was severely criticised for this purchase, both on account of the high price paid and because it was buying thousands of miles of railroad for the sake of a 500-mile connection. He said little, but began to send men trained in the Great Northern service to manage the Burlington. More and more Great Northern men came to the road as time went on and with them came Great Northern operating methods. The results which have been accomplished during the six years of Hill management are remarkable.

When the Burlington was taken over by the Great Northern and the Northern Pacific it was, like the Chicago, Milwaukee & St. Paul, essentially a local railroad, with the operating methods of a local railroad—small trainloads, light equipment and slow service. In the year ended June 30, 1902, the first year under Hill management (the Burlington was taken over April 1, 1901), the revenue trainload was 218 tons and the total trainload 251 tons. Last year the revenue trainload was 389 tons and the total trainload 444 tons. In 1902 there were 4,000,000,000 tons carried one mile with a freight train mileage of 18 300,000; last year, with a freight train mileage of 18,400,000, there were considerably over 7,000,000,000 tons carried one mile. Meanwhile the railroad lines have been greatly improved; old equipment of small capacity has been scrapped with what might seem like wasteful rapidity and replaced with new equipment, fast freight service has been established between Iowa, Nebraska and the Black Hills and Chicago, passenger service both through and local has been brought to a high standard of excellence and the road stands to-day strong, efficient and well equipped.

Since 1902 there has been an increase of 53 per cent. in gross earnings. Last year gross earnings were $82,500,000, against $74,100,000 in 1906 and $66,000,000 in 1905. Net earnings have not increased so fast but this is because the Burlington includes large improvement expenditures in its regular operating expense accounts instead of making special appropriations out of earnings.

It is particularly unfortunate that where this is the case no detailed figures of operating expenses are given, for this makes it impossible to analyze the expenditures in detail and form an opinion as to the amount spent on betterments. The only unit maintenance figure which can be obtained is that for maintenance of way per mile of road which on all roads operated and controlled, including some narrow gage mileage, was $1,584 last year, against $1,272 in 1906. It is necessary to look at the map to realize how generous is this figure. The Burlington is essentially a granger road with most of its mileage in the level prairie country between Chicago and the eastern line of Colorado and with a great clustering network of branch and feeder lines. If the records of the other two leading granger roads count for anything, this type of railroad is the cheapest kind there is to maintain. The Chicago & North-Western and the Chicago, Milwaukee & St. Paul each have a large mileage of branches and feeders in the prairie country. Last year the North-Western spent $1,185 for maintenance of way per mile, and the St. Paul $827 per mile. There is no obvious reason why the Burlington should have to spend any more than these roads. Therefore it is clear that an expenditure of nearly $1,600 a mile by the Burlington means that large improvements are being made directly out of earnings.

The same process of analysis cannot be applied to the maintenance of equipment accounts. But from indirect evidences it is likely that betterments are being charged to operating expenses almost as heavily in equipment. There were added to the equipment during the year 136 locomotives, 712 stock cars and 1,000 coal cars. This, however, probably does not by any means represent the value added to the equipment during the year. It appears that when an old wornout Burlington car of 30,000 or 40,000 lbs. capacity is broken up, it is replaced with a new and modern car of 60,000 or 80,000 lbs. capacity, and the whole cost of the new car charged to maintenance of equipment. This process is said to have been going on with especial rapidity of late.

With such limited figures at command, the most concise and accurate way to estimate the results of the money spent in operating expenses is to observe the proportion of gross earnings which was used on each of the separate accounts. Last year maintenance of equipment expenses amounted to 17.9 per cent. of gross earnings, against 18.4 in 1906 and 14.8 in 1905. Maintenance of way amounted to 17.5 per cent., against 15.2 per cent. in 1906 and 13.8 per cent. in 1905. These figures are clear proofs of the large and increasing amounts spent on improvements through the maintenance accounts.

Similarly the conducting transportation ratio shows the operating efficiency of the year as nothing else can. In 1906 of the gross earnings 30.2 per cent. went for conducting transportation. Last year, with all the wage increases, higher prices of supplies and other influences tending to raise the costs of getting and moving the business, and with 869,000,000 more tons moved one mile and 98,000,000 more passengers carried per mile, only 30.6 per cent. of gross earnings was required for conducting transportation. This small increase is a triumph of good management. General expenses, the other non-productive operating cost, was only 5.4 per cent. of gross, against 5.6 per cent. in 1906.

The few traffic statistics given show this operating efficiency. With an increase of 23,800,000 miles run by loaded freight cars, there was a decrease of 8,400,000 in the empty freight car mileage. The revenue trainload increased from 365 tons to 389 tons, and the total trainload from 420 tons to 444 tons. With a decrease in earnings per ton-mile, earnings per freight-train mile increased. An increase of 12 per cent. in passengers carried one mile was handled with an increase of 7 per cent. in mileage of passenger trains.

Neither the Great Northern, the Northern Pacific nor the Burlington give figures of tonnage carried by commodities. This would be particularly interesting in the case of the Burlington, because its mileage is so much more compact than that of either of the other roads. It is certain that one economy which has been gained during recent years—partly by the natural growth of the territory, partly by special efforts—is the development of a westbound back-haul. This would be indicated by the reduction in empty car mileage. The Burlington is a corn road rather than a wheat road, and is therefore likely to fare well during the next six months, for the corn crop is not only large, but the price is high. It also carries a great deal of live stock eastbound and merchandise westbound which it distributes to the various jobbing centers in Iowa, Missouri, Nebraska and Colorado. A description of its traffic by commodities would, in fact, be a summary of the products and business of the strip of territory between Chicago and Denver, which it so completely occupies.

In July, 1906, the line from Frannie, Wyo., south to Worland, 91 miles, was opened for traffic. An extension of this line from Worland south to Kirby, 20 miles, is now being finished. Since the close of the fiscal year the annual dividend rate on Chicago, Burlington & Quincy stock has been increased from 7 to 8 per cent., with an extra dividend of 6 per cent. This extra disbursement exactly refunds to the Great Northern and the Northern Pacific the amounts which they have paid during the last six years as the difference between the 7 per cent. received on the Burlington stock which they own and the 4 per cent. which they have paid on the joint Burlington bonds, which were issued at the rate of $200 for each $100 of Burlington stock.

The fifty-third annual report of the Burlington covers 36 printed pages. In proportion to its length it probably gives less real information than any other railroad report issued. The Great Northern and Northern Pacific reports are lacking enough, omitting as they do detailed figures of operating expenses, classification of tonnage by commodities and other important information, but the Burlington goes a step further. It is a pity that so great a railroad makes so incomplete an annual showing.

The following table shows the income results of all roads operated and controlled by the Chicago, Burlington & Quincy:

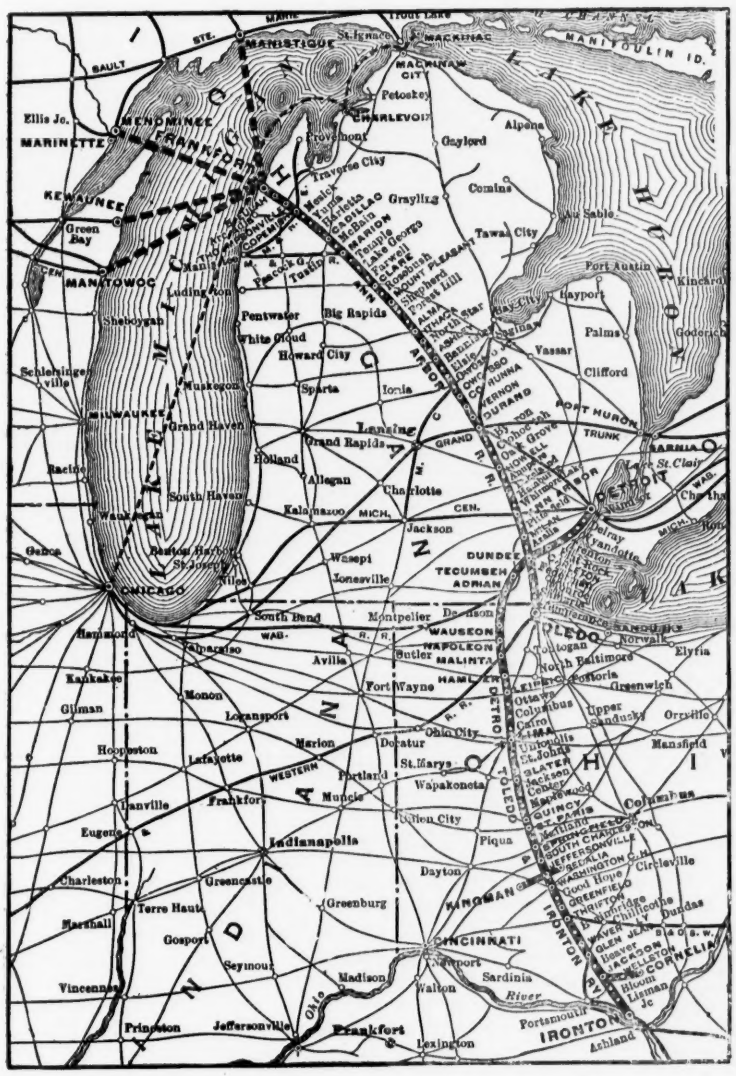
	1907.	1906.
Mileage worked	9,122	8,896
Passenger earnings	$18,666,973	$16,409,104
Freight earnings	56,516,689	51,168,339
Express earnings	2,000,149	1,456,990
Gross earnings	82,473,251	74,146,671
Maint. way and structures.	14,445,867	11,312,712
Maint. of equipment	14,725,632	13,639,942
Conducting transportation.	25,224,272	22,354,707
Operating expenses	58,904,988	51,463,642
Net earnings	23,568,263	22,683,029
Net income	13,155,207	12,742,430
Year's surplus	4,320,333	3,907,572

Detroit, Toledo & Ironton-Ann Arbor.

This is a combination of two small weak railroads. The combined lines run from the Ohio river to the northern part of Lake Michigan, from which there is connection by car ferry with a number of different ports on the western shore of the lake. The northern end of the line, from Frankfort, Mich., to Toledo, Ohio, is the Ann Arbor Railroad. The southern line, from Detroit, Mich., south to Ironton, Ohio, is the old Detroit Southern, now reorganized as the Detroit, Toledo & Ironton. The two roads were united in the hope of developing a larger aggregate of traffic by the alliance. This was successfully accomplished in 1906, the first year of combined operation, in which the combined net earnings were $1,300,000, against $739,000 in 1905 and the combined operating ratio 67 per cent., against 78 per cent. in the earlier year. The second annual report of the two roads shows that in 1907 there was only a slight increase in gross earnings, a decrease in net earnings and, owing to the application for the full year of the interest charges on new Detroit, Toledo & Ironton bonds, a large decrease in net income. The consolidated results for the last two years are shown in the table at the end of this review. In general the report takes up each of the two roads separately.

The Detroit, Toledo & Ironton, which showed great progress in 1906, went backward last year. Freight earnings decreased 4 per cent. and passenger earnings 3 per cent., while operating expenses increased 12 per cent. The reason gross earnings were larger than

in 1906 is that earnings from car per diem, car mileage and hire of equipment, which are included in gross earnings, were over twice as large as in the previous year. Receipts from these sources amounted to $434,334, against $205,553 in 1906, an increase of 111 per cent. The 1907 figure is over twice as large as the total receipts from passenger, mail and express earnings. It is probable that there is no other railroad with as much mileage (438 miles) which makes this showing. These earnings, instead of being an advantage to the road, are small recompense for being deprived of a large part of its equipment for several weeks or months of the year. It has a large tonnage of coal for domestic consumption which moves mostly in the fall and early winter and is destined to a great many different points off the line. Once these cars leave the road they are generally not returned till spring. Meanwhile the company is unable to satisfy the legitimate demands of its own shippers. Last year these shippers, unable to obtain cars, complained to the Railroad Commission of Ohio. In reply the Ohio authorities threatened to revoke the charter of the company if cars were not furnished more promptly to shippers. The company's



Detroit, Toledo & Ironton-Ann Arbor.

position is that if it had ten times as many cars they would, under present conditions, be loaded out during October and November and not returned, and shippers would be little better off than they were last year during the winter months. The Detroit, Toledo & Ironton, therefore, is a road on which the present conditions of car interchange have fallen with particular severity. The raising of the per diem rate from 25 cents to 50 cents a day last summer will increase its car service earnings, but it is obvious that even this increase will nowhere nearly make up for the hardship of being deprived of large numbers of cars for which loading is available. This state of affairs is probably largely responsible for the decrease in freight earnings.

One reason for the increase in operating expenses was that more was spent on the maintenance accounts. There was only a small increase in the non-productive accounts. Maintenance of way cost $723 per mile, against $628 in 1906; and repairs and renewals of equipment $1,704 per locomotive, against $1,055 in 1906; $474 per passenger car, against $322 in 1906, and $28 per freight car, against $22 in 1906. These are low figures, particularly in the freight car item. An average of $25 a year will not maintain modern freight equipment. The showing is made worse by the fact that no new equipment of any kind was bought during the year.

Net earnings were $555,000, while fixed charges amounted to $927,000, leaving a deficit for the year of $372,000. There was a previous profit and loss deficit of $305,000, so that the Detroit, Toledo & Ironton on June 30, 1907, showed a total profit and loss deficit of $677,000.

The Ann Arbor had a trifling increase in gross earnings and a decrease in net earnings. Freight earnings increased 1 per cent. and passenger earnings 5 per cent. Net earnings and other income were $794,000 with which to meet fixed charges of $417,000. This left net income of $377,000 which, carried to profit and loss, made a profit and loss credit balance of $1,600,000. It will be observed that the year's net income overbalances by $5,819 the Detroit, Toledo & Ironton's net deficit.

The Ann Arbor spent less than in the previous year on maintenance. Its increase in operating expenses was in conducting transportation. Maintenance of way cost $864 per mile, against $1,029 in 1906. This is a large decrease, particularly for a year when costs were generally higher. Equipment repairs and renewals cost $1,337 per locomotive, against $1,462 in 1906; $678 per passenger car, against $519 in 1906, and $63 per freight car, against $69 in 1906. The locomotive figure is low; the others fairly adequate.

The prospects for the present year are said to be favorable for both roads. Whether the increased capacity and activity of the different industries mentioned will continue in face of the present depression is a question. A new traffic development is the beginning of special train service from Toledo to Detroit to handle coal for the Solvay Process Company and coal dealers in Detroit. This train has had an average of about 20 cars a day since it has been running. The Ann Arbor is increasing its summer tourist travel. To extend its possibilities in this direction it has canceled its contract with the American Palace Car Company and made a contract with the Pullman Company. As a result a Pullman sleeping car line was established on July 1, 1907, between Columbus, Ohio, and Frankfort, Mich., in connection with the Hocking Valley between Columbus and Toledo. This car was operated in each direction three times a week until September 1 and brought satisfactory returns.

The following table shows the results of the past two years, during which time the two roads have been operated together. The detailed figures of earnings and expenses of the Detroit, Toledo & Ironton and the Ann Arbor are added so as to show them for the combined properties.

	1907.	1906.
Mileage worked	734	728
Passenger earnings	$637,474	$618,715
Freight earnings	3,001,368	3,056,050
Per diem & equip. earn'gs	434,334	224,702
Gross earnings	4,298,925	4,118,809
Maint. way and structures.	572,404	574,228
Maint. of equipment	699,140	602,626
Conducting transportation.	1,624,783	1,510,564
Operating expenses	2,978,604	2,775,628
Net earnings	1,320,320	1,343,181
Net income	5,819	159,764
Year's surplus	5,819	159,764

Bangor & Aroostook.

This is a local railroad operating nearly 500 miles of line in northeastern Maine. Its southern terminus was at Oldtown up to the latter part of 1905. On November 4, 1905, the extension south to Searsport was opened for operation and since that time a branch has been built connecting this line with Bangor. Work was begun last spring on a cut-off from South Lagrange north to the main line between Schoodic and Seboois. This is to be put in operation shortly. It is a shorter route with lower grades than the old line. As shown by the map, an extension of this line, known as the Allagash Line, is projected north through the wilderness about Mt. Katahdin, to a connection with the Temiscouata Railway at its eastern terminus on the St. John river.

The Bangor & Piscataquis Railroad and its leased line, the Bangor & Katahdin Iron Works Railway, were the beginning of the Bangor & Aroostook. Together in 1893 they had 95 miles of main line and gross earnings of $185,000. The Bangor & Aroostook in the next near operated 142 miles with gross earnings of $246,000. The year ended June 30, 1907, shows an average operated mileage of 482 miles and gross earnings of $3,200,000. Yet President Cram believes that the development of the natural resources of northern Maine is but fairly begun.

Certainly the record of the past year shows a gross traffic which last year increased too fast for the most profitable results. Even after an improvement appropriation smaller by $65,000, there was a deficit for the year of $28,000 compared with a surplus of $73,000 in 1906. This was the result of payments amounting to $152,000 on new car trusts. These were charged by the company to profit and loss instead of to income, so that the company's income account shows a surplus for the year instead of a deficit.

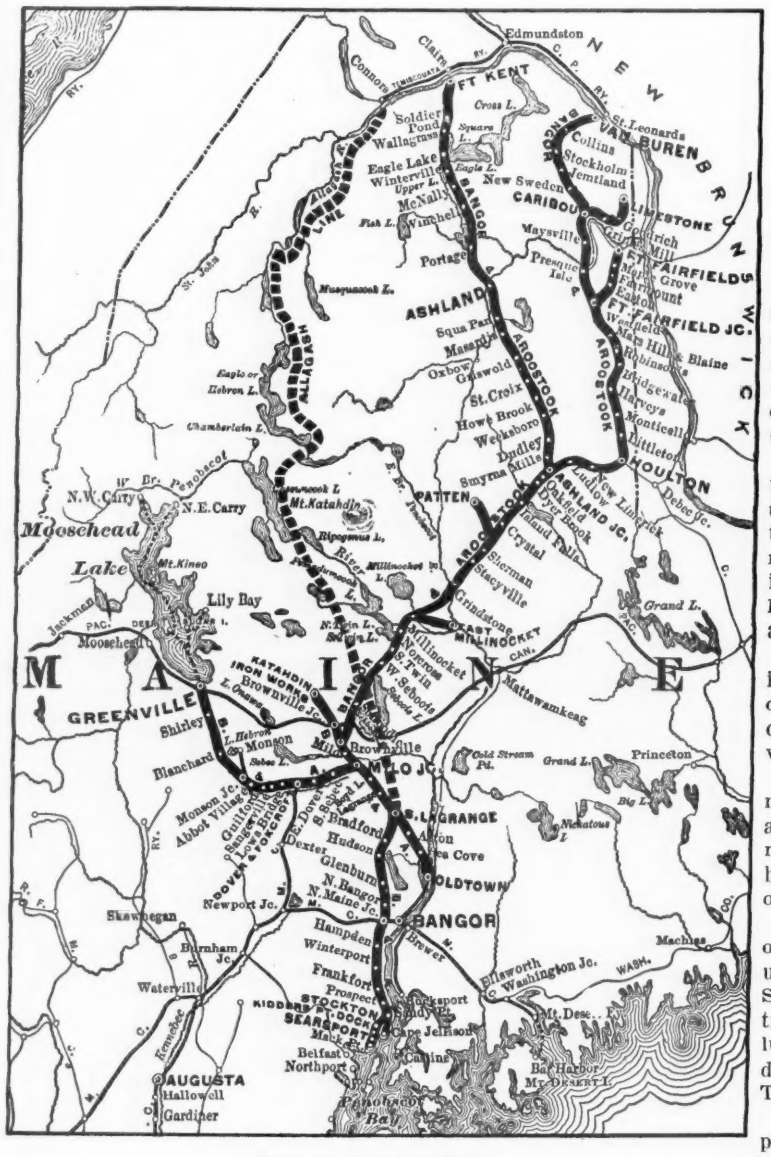
Gross earnings were $3,200,000, against $2,500,000 in 1906, an

increase of $700,000, or 29 per cent. Operating expenses increased $600,000, leaving net earnings of $1,088,000, against $952,000 in 1906. Fixed charges and taxes increased $281,000, as a result of additional bonds and car trusts issued during the year, so that the net income was only $143,000, against $300,000 in 1906.

Freight earnings increased from $1,700,000 to $2,300,000 or 35 per cent. Passenger earnings increased 11 per cent. There were large increases in each one of the four operating expense accounts.

Maintenance of way cost $1,141 per mile, against $859 in 1906, a distinct advance in the standard of roadway maintenance. Repairs and renewals of equipment cost $886 per locomotive, against $625 in 1906; $360 per passenger car, against $338 in 1906, and $40 per freight car, against $33 in 1906. The locomotive figure in both years is extremely low; most large railroads spend twice as much, or more.

Conducting transportation cost $1,100,000, against $830,000 in the previous year, an increase of 33 per cent. There were particularly large increases in wage payments. Wages have been advanced,



Bangor & Aroostock.

according to President Cram, beyond the company's reasonable ability to pay them. He hopes, however, that the company will be compensated by increased fidelity to duty.

The winter was the most severe in the history of the road, in its effect on both roadway and equipment. At the same time the offerings of traffic were unprecedentedly large. These difficulties were aggravated by delay in the delivery of new freight cars, which were to have been received in September. They did not arrive until several months later, after the potato crop, one of the most important items of the Bangor & Aroostook's traffic, had been harvested. It is estimated that the direct and indirect cost of operation was increased from $40,000 to $50,000 above the usual cost during the winter and that there was a decrease of from $50,000 to $75,000 in earnings, through the severity of the weather and the lack of expected equipment.

Freight traffic by commodities for the last seven years is reported. This shows that the potato traffic has increased from 98,000 tons in 1901 to 382,000 tons last year. Forest products, which were 381,000 tons in 1901, amounted to 540,000 tons in 1907. Paper tonnage has risen from 36,000 tons in 1901 to 97,000 tons last year. There has been a specially large increase within a year in the tonnage of cement, brick and lime, which rose from 19,000 tons in 1906 to 54,000 tons last year. The average distance which each ton of freight was hauled increased from 106 tons in 1906 to 121 tons last year. The train load increased from 192 tons to 221 tons, and the loaded carload from 16 tons to 17 tons.

The following table, rearranged according to our usual method, shows the operations of the last two years:

	1907.	1906.
Mileage worked	482	456
Passenger earnings	$615,908	$544,870
Freight earnings	2,340,390	1,743,267
Per diem & equip earnings	152,916	121,925
Gross earnings	3,221,696	2,496,547
Maint. way and structures.	552,010	391,565
Maint. of equipment	344,000	210,803
Conducting transportation.	1,093,465	829,733
Operating expenses	2,133,295	1,544,670
Net earnings	1,008,401	951,877
Net income	143,439	299,773
Dividends	71,840	62,000
Improvement appropriations.	99,626	164,842
Year's surplus	28,027*	72,931

*Deficit.

CONTRIBUTIONS

Rail Specifications—The Discard from the Ingot.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Beyond question the railroads of the country rightfully bear the full responsibility for laying safe rails in their tracks. On neither moral nor legal grounds can they claim exemption because they have bowed to the arbitrary power of the steel rail pool that has fixed both price and quality. It is true that a condition that thus places responsibility without voice in the determination of quality is unfair. But what have the injured parties, the railroads, done to assert their rights?

Over five years ago the rail manufacturers unitedly deprived the railroads of the inalienable right of the purchaser to specify the quality of the material for which his money is expended; and the railroads meekly submitted, against the protests of their technical advisers. It is only within the past year that the alarming increase of rail breakages, even with larger sections and weights, have awakened the railroads and the public to the necessity of action compelling the manufacturers to improve their output.

That the manufacturers should be most interested in profits is but natural. That is what their stockholders demand. On the other hand it is equally the duty of the railroads, in the interests of their stockholders and the public, to insist on getting that for which they are paying—a safe, sound rail.

The technical officers of the railroads, through the more prominent technical societies of the country, have endeavored to bring about the desired result by drafting rail specifications; but the manufacturers have been successful in preventing their adoption, by indifference and antagonism. For traffic and other reasons no one railroad could singly compel the needed reforms.

Realizing the necessity of united action, the executive officers of all railroads, through the American Railway Association, took up the question about a year ago. Its Standard Rail and Wheel Section Committee has had many meetings, attended by representatives of the manufacturers, technical societies and prominent metallurgists, and unanimous agreements have been reached on various details, including amended rail sections and chemical composition. The question of discard, however, is still unsettled.

Regarding rail sections, all interests have agreed that to secure proper working of material, with uniformity of texture and absence of internal strains, the metal must be more evenly distributed between head and base than is done in the sections now in use. This conclusion has resulted in the selection of two types of rail sections, one with a high moment of inertia and wide shallow heads, for use by railroads preferring stiffness and smooth-riding qualities; and the other with less height and with deep, narrow heads for withstanding heavy traffic on tortuous alinement.

As to chemical composition, the railroads desire as low as possible percentage of phosphorus, so that the proportion of carbon may be correspondingly raised with safety, and thus produce a rail that will wear well. An attempt has been made to secure .085 phosphorus, but the ores available for the great majority of the rail tonnage of the country makes impracticable the securing by the Bessemer process of less than .10 per cent. It is true that foreign demands are often met with the better class of ores to the detriment of the domestic product, but the quantity is comparatively so small as to not affect the situation. Therefore until the open hearth process is more widely employed, the railroads are forced to the use of .10 phosphorus, with a correspondingly low percentage of carbon. This means a safe but soft rail.

The minimum discard continues to be a bone of contention,

and is really the most important of all. No matter how carefully the section is designed for obtaining suitable heat treatment, nor how the chemical composition is regulated, if the material in the rail is not homogeneous and contains hidden defects, the result will be an unsafe rail. The manufacturers all agree that the upper part of the ingot contains cavities and segregated elements which cause pipes, flaws, brittleness and other undesirable faults in the rail rolled from that portion, and they agree that the nearer the bottom is approached the better the material. But, with the exception of one company, the makers claim that an arbitrary discard will be unfair; and that the inspectors of the railroad companies should require the removal of only such part of the ingot, as each instance demands for the securing of sound metal. The dissenting rail company, one of the best in the country, admits that for average conditions a discard of less than 20 per cent. is not to be recommended, and that company is now making a specialty of supplying rails with that amount of discard.

Such experts on rail manufacture as Dr. C. B. Dudley, of the Pennsylvania, and Capt. R. W. Hunt assert that the railroads cannot afford to do otherwise than unite on the requirement of a definite discard; and the latter believes that not less than 20 per cent. is essential for a safe rail under the usual methods of casting ingots. Both the American Society of Civil Engineers and the American Railway Engineering and Maintenance of Way Association have declared in favor of a 25 per cent. discard.

To leave this most important matter for the railroads' inspectors to decide appears to be very unwise, for how can they be expected to secure from the manufacturers that which their superior officers, the highest engineering officers of the railroads, have for five years been unable to get?

It is true that a definite discard will work some hardship to those progressive mills that cast a superior ingot, but for such exceptions special agreements can be made for a modified discard. The arbitrary standard is absolutely necessary for the protection of the railroads. It can, of course, be modified by the united railroads from time to time as improved methods of casting the ingot shw the safety of so doing.

To summarize: The agitation of the rail question seems to be leading the united railroads of the country to the ultimate adoption of the following policies:

(1) Two alternative types of rail sections, with a distribution of metal that will be favorable to proper rolling.

(2) Chemical composition in which the relation of carbon to .10 phosphorus in the Bessemer process of manufacture will insure safe but soft rail.

Charles E. Perkins.

(3) Definite discard from the top of the ingot, probably not less than 20 per cent. and enough more, in the inspector's opinion in each instance to secure sound metal.

(4) Gradual supplanting of the Bessemer by the open-hearth process of manufacture, so that with the lower phosphorus thus obtainable the carbon may be raised and thereby overcome the objectionable uneconomical softness of rail that seems inseparable from the Bessemer process.

When it is realized that the safety of travel on American railroads is even more dependent on the quality of rails than on the bridges that are the subject of so much solicitude and expense, is it too much to ask that no efforts be spared by all those burdened with the responsibility of safeguarding the traffic entrusted to their care, to get the best rail that money will buy?

RAILROAD OFFICER.

The Prussian railroad loan bill of April 13, 1907, provides funds for the following purposes:

1.	For building new railroads	$26,688,960
2.	For double-tracking and construction connected therewith	17,191,200
3.	For various short connections and to cover deficits in constructions previously authorized	5,869,200
4.	For material for lines being built	2,400,000
5.	Subsidies for building light railroads	1,200,000
	Total	$43,349,360

Charles E. Perkins.

Charles Elliott Perkins, who died recently at his home at Westwood, Mass., was President of the Chicago, Burlington & Quincy for 20 years up to 1901; he remained a director of the company until his death. The importance of this latter office, in Mr. Perkins' mind, may be judged from a piece of history which has been made public only since his death. He had been made, without his knowledge, a director of a bank. The institution was not solvent and Mr. Perkins served as a director under protest. The bank failed and although he owned only $10,000 of its stock and accordingly was liable for but $20,000, he contributed $1,000,000 to reimburse depositors. This he did feeling that the use of his name on the list of directors had made him morally liable for losses sustained by those who may have been influenced by his presence on the board to deposit their money. Mr. Perkins was born in Cincinnati, Ohio, on November 24, 1840. All his railroad work was on the Chicago, Burlington & Quincy, where, although he held the highest operating offices, his work was primarily in the financial department. He began when he was 19 years old as a clerk in the office of the Assistant Treasurer of the Burlington & Missouri River, later merged with the Burlington. He was made cashier of the company and in 1862 was appointed Assistant Treasurer and Secretary. Three years later he was made General Superintendent. He served in this office for eight years and was then made Vice-President of the lines in Nebraska. In 1880 he was elected Vice-President and General Manager of the Chicago, Burlington & Quincy, at the time of the consolidation, and a year later was elected President. He retired from this office on February 20, 1901.

The Present Status of Mechanical Refrigeration in Railroad Work.

BY JOS. H. HART.
Randal Morgan Laboratory of Physics; University of Pennsylvania.

Mechanical refrigeration in the production of ice and cold storage is no longer a novelty in the industrial world to-day. Being a somewhat modern application, however, its development has steadily progressed, with considerable change from time to time, so that there has been no opportunity for general standardization of plants as yet, and in some fields the development of this particular branch has scarcely commenced. This is particularly so in the railroad world. Mechanical refrigeration has proved its efficiency and ability in cold storage plants, department stores, hotels and in the large ocean steamers, both for freight and passenger service. However, in railroad work natural ice still holds its original position in the great majority of cases, in spite of the fact that in other departments it is hopelessly outclassed. The reason for this is not entirely clear. It is probably due to the fact that cold storage has been considered of minor importance in railroad transportation up to the present time, but this department of the business of a railroad is steadily becoming more and more important with enormous opportunities for profitable development in this field.

In order to understand the position of mechanical refrigeration in regard to natural ice, it must be remembered that both exist to-day on the market, in apparent competition. There exists, however, no recent competition, in the strictest sense of the word. Artificial ice can be produced much cheaper than natural ice under almost any conditions. When the fact is considered that natural ice merely involves first cost on plant, cost of harvesting, storage and conveyance to the market, together with loss due to melting, this is no small achievement. Artificial ice can be produced in large plants readily at a cost of about 50 cents a ton, if the plant is of ordinary efficiency. In isolated cases this cost can be lowered as far as a minimum of 43 cents a ton, and this represents about the lowest limit. Thus, natural ice, except in a few isolated cases, where the cost of plant and equipment become practically negligible, is no competitor. The reason for the existence of natural ice in the market to-day, under any circumstances, is merely due to the fact that

sufficient artificial ice to satisfy the demand is never produced. Practically, artificial ice men have a ready market for their output at prices fixed to allow natural ice a reasonable profit. As an illustration of the remarkable progress of artificial ice to-day, and the inadequacy of the supply, it can be stated that over 4,000 new refrigerating plants were installed in the United States alone last year.

The situation in railroad work is essentially as follows: Natural ice is the chief source of cold storage here, and the competition with artificial ice in this department has not been as great as in other lines, owing to the fact that freight charges are generally negligible. Thus, ice is generally cut and stored at points along the railroad, wherever obtainable, and at the same time in locations suitable for utilization. When it is necessary to convey this ice to other points, the freight rate is not considered in the great majority of cases as a cost factor in its production. Thus, natural ice occupies a stronger position in the railroad world in regard to its competitor than in any other of its utilizations. That it is incorrect for the railroads to neglect freight rates on their own ice in a consideration of the cost of production is a foregone conclusion.

Another reason of considerable importance, tending to explain the backward position of the railroads in regard to mechanical refrigeration, is due to the fact that the applications of mechanical refrigeration for cooling purposes in railroad work are varied often almost as much as the different kinds of perishable freight. Further, mechanical refrigeration has been in a constantly changing development, and the manufacturers of refrigerating machines have readily found a wide open market without entering this field. The field is a difficult one to satisfy, since perishable freight requires different kinds of refrigeration for its transportation. Thus, most fruit cargoes require a temperature of about 60 deg. Fahr. maintained throughout transit for their best conveyance. Milk and dairy products suffer less when conveyed at a temperature of about 50 deg. Fahr. Meats and many additional provisions carry best below the freezing point, whereas eggs and other commodities utilize 35 to 40 deg., and are spoiled with much variation from this temperature. Again the nature of the business itself, namely, transportation, renders the application of mechanical refrigeration to cold storage when in transit a necessarily difficult matter. Thus, mechanical refrigeration loses a number of its advantages of direct application for a definite purpose, and generally wherever applied it has been as an intermediary in the process. The mechanical refrigeration has almost invariably been used to produce artificial ice, and this ice in turn used to produce the refrigeration, and hence it loses much of the economy due to its direct utilization. Hence, when all these conditions are considered, it is not surprising that mechanical refrigeration has found easier lines of development, and has not troubled the railroads to any great extent. To-day, however, mechanical refrigeration is applied in a number of developments of railway work. The United Fruit Company has a number of cooling plants in operation throughout the country for the refrigeration of its product in transit. A large number of railroads have cold storage houses operated by mechanical refrigeration in existence in the large cities for the storage of the perishable products immediately after transit. These houses, of course, in some places also utilize refrigeration in ice production, which sometimes finds its way into the cars in transit, but this is of comparatively minor significance in regard to the entire output. The Railway and Stationary Refrigerating Company utilizes mechanical refrigeration in car units for the conveyance of milk in the vicinity of New York, as has been said. This requires a temperature of about 50 deg. and has been fairly efficient in this application. The general development of single refrigerating car units has not progressed, however, to such an extent as at one time seemed inevitable. This is due almost entirely to mechanical difficulties. A refrigerating machine requires power and cold water for its operation, and considerable care in its maintenance. These three factors tend largely to eliminate the use of the unit car refrigerating plant. Ammonia is generally recognized as the best substance for the conveyance of heat in refrigeration and occupies a place analogous to water in the production of power in the steam boiler. However, the difficulties encountered in the use of ammonia, due to its high pressure and the large quantity of cold water required for its condensation, has resulted in the adaptation of other less efficient fluids for the operation of these machines in this field. Thus, in the example mentioned, methyl chloride is used as a refrigerating agent, with considerable saving in the design of the machine and the difficulty of maintenance, but with a remarkable diminution in efficiency in comparison to the ammonia type. The fact that this substance can be used in this application with any degree of success whatever speaks volumes for the availability of refrigeration in this field.

Among the other points which apply throughout the development in the application of mechanical refrigeration in this field is the fact that a large number of different types of refrigerating machines and systems are used. Thus, there are in existence to-day refrigerating machines using three different principles in their operation. The air machine, which uses air, either at atmospheric pressure or under pressure and cools the same by causing the compressed air to do work, thus changing the heat in the air into work, which is taken out, leaving the air cooled. Air as low as 140 deg. Fahr. below zero has been obtained readily by this method. This machine is often convenient on shipboard where the use of ammonia or other refrigerating substances may prove undesirable, but it is clumsy and inefficient in operation, and the first cost is from two to three times that of an ammonia machine. In addition, it never exists in large units, and all statements which have ever been made in regard to increased efficiency of large plants over small ones in any field whatsoever almost without exception apply equally in this field.

The liquifiable gas machine utilizes the latent heat of vaporization of water liquids for the production of cold. Thus, in order to make water boil, heat must be applied. If the water can be made to boil without this application, heat is taken from the water itself with a consequent cooling effect on the water. The boiling point of water is too high to use in this application, hence a class of substances known as volatile liquids are used. Ammonia, sulphurous acid, methyl chloride, benzine and a large number of other substances have been used. Even gasolene has been developed as a refrigerating agent in this field. The material produces the refrigeration automatically by boiling away, if its boiling point is below the temperature of surrounding bodies.

The sole end of the machinery in mechanical refrigeration as developed in this type is for the purpose of saving and reutilizing the refrigerating material. As has been said, ammonia is by long odds the most efficient agent for this purpose. It operates, however, at about a pressure of 180 lbs. for the regeneration device, and this has been a serious objection to its utilization and development in the unit car system. The regeneration of ammonia is accomplished in two ways, by means of a compressor, which compresses the exhaust gas until it attains a condensing temperature and pressure above that of the atmosphere, whereupon it is spontaneously condensed. The absorption machine, on the other hand, utilizes the absorption power of water for ammonia gas and the loss of this power with rise in temperature to produce the same effect. Regeneration is accomplished by the application of heat to the mixture with the evolution of the gas at a temperature and pressure sufficient to permit condensation.

Now these two types, the ammonia compression and absorption machines, are the only really efficient types on the market. The compression machine is much simpler in theory and operation, but has considerable less efficiency in the actual process of production than the absorption type. This latter has comparatively few moving parts, is almost automatic and is generally installed in large units.

In the application of mechanical refrigeration in railroad work, not only must all of these types be considered with their relative efficiencies and various advantages for different purposes, but a host of other conditions arise, since the mere installation of a refrigeration plant at certain localities along a railroad is not the accomplishment of transportation of perishable freight. As has been said, the cheapest and best method of applying this mechanical refrigeration has been through the production of ice as an intermediary. Further, the efficiency of the various types of refrigerating machines depends almost absolutely upon the duty they are to perform. Thus, the compression machine is superior for mild refrigeration, whereas the absorption is infinitely superior for sharp or extreme refrigeration. In the production of ice the absorption is superior, depending only upon the size of the plant. For large plants its relative efficiency increases almost in direct proportion to the size of the plant. The use of ice as an intermediary involves a selection from several different methods for its production. All these factors must be considered in the installation of mechanical refrigeration in railroad work. Further, its situation with respect to available coal and water is a matter of much importance, and many of the large refrigerating plants in large cities have their scale of profit dependent almost absolutely upon this supply and the temperature of the water. Large quantities of cold water are required in the operation of a refrigerating plant of any type, and it can be said in a general way, the more water and the colder it is the greater will be the efficiency and the profit resulting in mechanical refrigeration.

Individual unit refrigerating cars probably will never attain any great amount of success. A refrigerating machine is a complicated mechanical mechanism and requires care and attention, and practically all automatic machines at present on the market have proven failures at the present stage of development. With the large variations in mechanical refrigeration design and its various applications in transportation, the use of ice or possibly cold brine as an intermediary in the application of the refrigeration is extremely probable in this field. The chief development in railroad work of this department will be in the construction of larger and larger refrigerating units, with special care paid to the distribution of these units, not only in respect to freight transportation, but also cost of production of refrigeration, not only from a coal and water consumption viewpoint, but also from a cost of handling the refrigerating material and making it available in transportation. Many

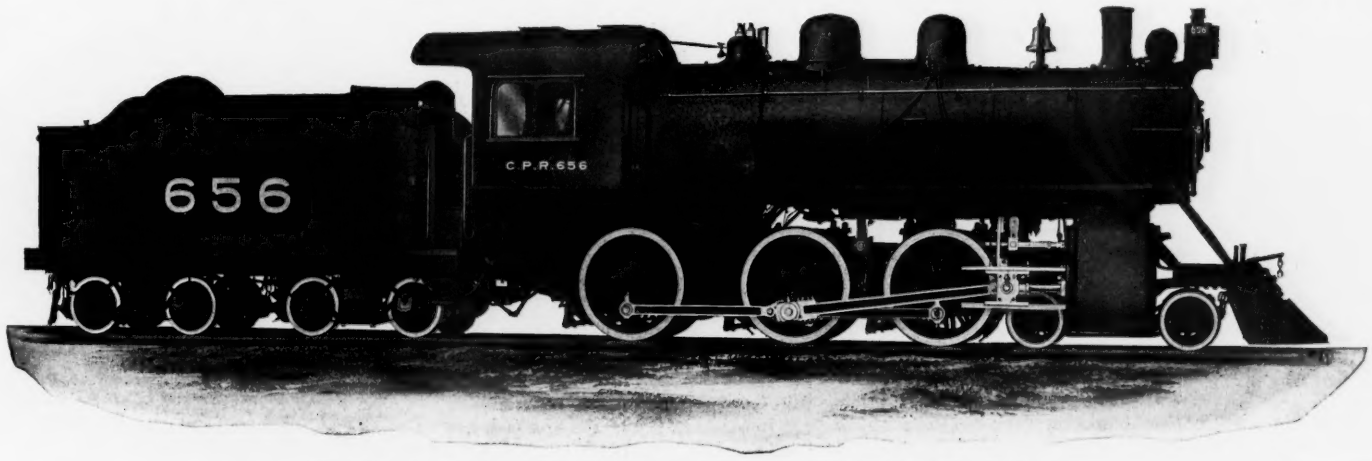
improvements are possible in this line, and it is unfortunate that the great majority of railroads do not consider the mechanical end at all in the installation of such plants. They appear to be interested merely in the transportation end of the business, and the two are so irrevocably connected in this particular field that it is not surprising that the results obtained in the present actual developments have not been as satisfactory as could be desired.

Ten-Wheel Locomotive with Superheater for the Canadian Pacific.

The Canadian Pacific has been the pioneer in the introduction of the superheater on American railroads. In April, 1906, H. H. Vaughan read a paper on the subject before the New York Railroad Club, an abstract of which was printed in the *Railroad Gazette* of April 27, 1906. At that time there were nearly 200 locomotives in service or on order with superheaters, the majority being fitted with the Horsey-Vaughan type which has been developed on the Canadian Pacific. It resembles the Schmidt firetube superheater in the general principle of a return tube for the steam located in the fire tube. In the newest ten-wheel engine, shown in the accompanying illustration, the arrangement of the front end is essentially the same as in the design of a year ago. A header taking steam from the dry pipe is placed just back of the petticoat. Steam enters the top of this header and passes out through solid drawn, weldless steel tubes having an inside diameter of $^{15}/_{16}$ in. These tubes are upset at one end and are forged and bent by a bolt header and bending machine to the shape shown. They are connected by bronze union nuts to special cast-steel fittings which screw into the header; a $^{1}/_{16}$-in. copper gasket being used in the union nut. These small tubes extend into large 5-in. superheater firetubes to within about 30 in. of the back tubesheet, where they connect with heavy cast-steel return bends. The steam returns from the return bends through 1¼-in. tubes which connect through union nuts and special cast-steel fittings similar to those mentioned above, with the fingers of the bottom header which is shown in detail. The steam pipes which connect this header with the cylinder casting are very short and there has been no difficulty in keeping the joints tight. Each large superheater firetube contains two of the small tubes from the top header and the corresponding tubes to the bottom header. The return bend has lugs cast on it which spaces it properly from the sides of the large tube and the other set of small tubes so that there is a uniform circulation space about them all.

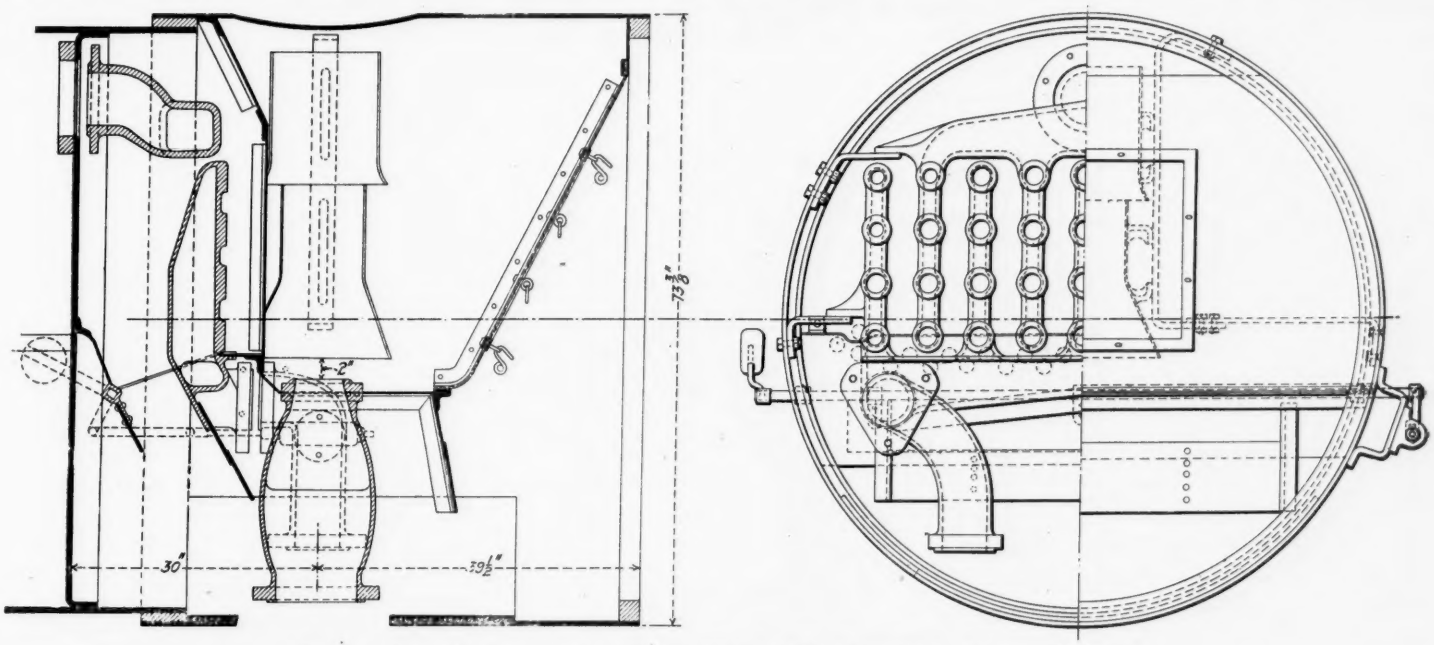
The gases as they issue from the superheater firetubes enter an enclosed space that is controlled by a damper. When this damper is closed there is no circulation of gas through the tubes and danger of burning is obviated by so closing it when steam is shut off.

As a result of the work that has been done with the superheater on the Canadian Pacific there has been a lowering of the steam pressure on these engines with a corresponding increase in the size of the cylinders. This is in accordance with the probable economies that have been outlined from time to time since the subject of high steam pressures and the use of superheated steam has been under discussion. It is also expected that this reduction will result in the lessening of boiler troubles.



Ten-Wheel Locomotive with Superheater; Canadian Pacific Railway.

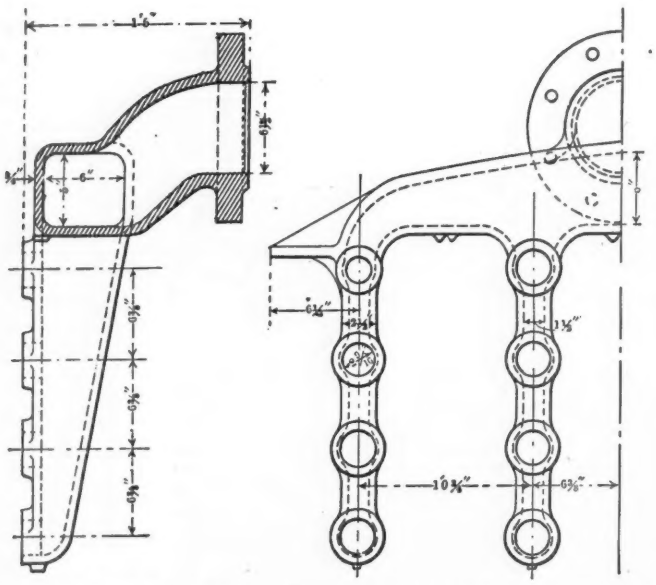
The engines illustrated, which were built by the Locomotive & Machine Co., of Montreal (American Locomotive Company), are practically identical in design with a previous order, also equipped with superheaters, built by the same company for that road, except for an increase of 1½ in. in the diameter of the cylinders and a reduction of 20 lbs. in the boiler pressure. In working order they have a total weight of 192,500 lbs., of which 142,500 lbs. is carried on the driving wheels. The cylinders are 22½ in. in diameter by 28 in. stroke, and with driving wheels 63 in. in diameter and a working pressure of 180 lbs., the engines have a theoretical tractive power of 34,410 lbs.



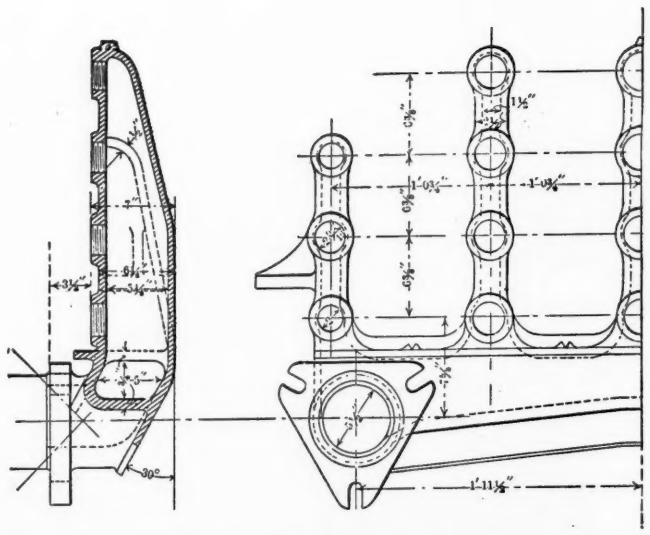
Smoke Box Arrangement with Superheater; Canadian Pacific Railway.

The boiler is of the wagon top type, the outside diameter of the first and smallest course being 70⅜ in. It is fitted with 240 boiler tubes, 2 in. in diameter, and 24 superheater firetubes 5 in. outside diameter. The total heating surface is 2,403 sq. ft., of which the tubes contribute 2,237 sq. ft. and the firebox the remainder. The firebox is 102⅛ in. long and 69⅞ in. wide, and has a grate area of 50 sq. ft.

These dimensions and this data take on a new significance when the ratios that are given in the table to follow are compared with



Top or Saturated Steam Header for Vaughan Superheater; Canadian Pacific Railway.

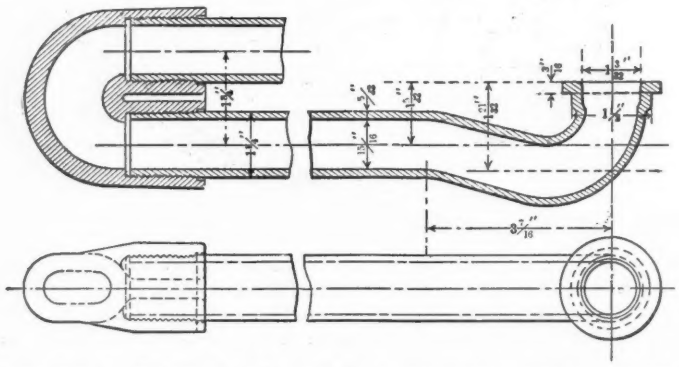


Bottom or Superheated Steam Header for Vaughan Superheater; Canadian Pacific Railway.

those of engines built along the usual lines. There are two influences that predominate in these changes of ratio: the diameter of the cylinders, and the reduction of the heating surface by the use of a fewer number of large tubes. To make a specific comparison, take the ten-wheel (4-6-0) locomotive for the Chicago & North-Western illustrated in the *Railroad Gazette* of July 5. That engine has approximately the same weight on drivers (134,000 lbs.), and is the same type of locomotive. The ratios are, however, quite different. For example:

		C. & N.-W., without superheater.	C. P. R., with superheater.	Difference in per cent. Chic. & N.-W. as base.
$\frac{\text{Weight on drivers}}{\text{Tractive effort}}$	=	4.37	4.14	— 5.27
$\frac{\text{Tractive effort x diam. drivers}}{\text{Heating surface}}$	=	666.0	901.4	+ 36.57
$\frac{\text{Heating surface}}{\text{Grate area}}$	=	64.0	48.1	—24.85
$\frac{\text{Weight on drivers}}{\text{Heating surface}}$	=	46.0	59.28	+ 28.52
$\frac{\text{Total weight}}{\text{Heating surface}}$	=	59.48	80.05	+ 51.39
$\frac{\text{Volume of 2 cylinders, cu. ft.}}{\text{Firebox heating surface}}$	=	5.09	7.00	+ 37.52
$\frac{\text{Total heating surface}}{\text{Vol. 2 cylinders}}$	=	284.0	186.72	—34.25
$\frac{\text{Heating surface}}{\text{Grate area}}$	=	4.45	3.88	—12.81
Equated heating surface, sq. ft.	=	853.79	759.8	—11.11
Tractive effort	=	30,900	34,410	+ 11.36

This comparison brings out very forcibly the effect of the use of the superheater, and this is further emphasized by the last two



Superheater Tubes with Upset Ends and Return Bend Connection; Canadian Pacific Railway.

figures of the table where it appears that with 11.36 per cent. more tractive effort the engine with the superheater requires 11.11 per cent. less equated heating surface. All through the list the differences will be surprising to those who have not already made similar comparisons. And it must be remembered that these ratios and dimensions are not the result of theoretical calculations based upon assumptions, but are those that actual practice has found to be such that satisfactory and economical results will be obtained in the every-day working in regular service. And whether it is conceded or not that the superheater is an economical device to apply, when everything is taken into consideration, these figures are at least an interesting exhibition of what can be done.

The following are some of the principal dimensions of these engines:

Cylinders, diameter	22½ in.
Piston stroke	28 "
Wheel base, driving	14 ft. 10 "
" total engine	26 " 1 "
" engine and tender	54 " 6½ "
Weight in working order, drivers	142,560 lbs.
" " " " engine	192,520 "
" " " " engine and tender	318,830 "
Heating surface, tubes	2,237 sq. ft.
" " firebox	166 "
" " arch tubes	2 "
" " total	2,405 "
Grate area	50 "
Journals, main driving	9½ in. x 12 in.
" trailing, driving	9 " x 12 "
" engine truck	6 " x 10 "
" tender	5½ " x 10 "
Steam pressure	180 lbs.
Firebox, length	102⅛ in.
" width	69⅞ "
" thickness crown and back sheets	⅜-in.
" " side sheets	5-16-in.
" " tube sheet.	½-in.
" water space, front	5 in.
" water space, back and sides.	4½ "
Tubes, number	240
" number, superheater	24
" length	14 ft. 4 in.
" diameter	2 "
" diameter superheater	5 "
" material superheater	Manseman steel
" thickness	No. 11, I. W. G.
Tank capacity, water	5,000 gals.
Tank capacity, fuel	10 tons
Valve, travel	6 in.
" lap	⅞-in.
" exhaust clearance.	⅛-in.
" lead	0
Wheels, diameter, driving	63 in.
" " engine truck	31 "
" " tender	34 "
Tractive effort	34,410 lbs.

$$\frac{\text{Weight on drivers}}{\text{Total weight}} = 74.04^*$$

$$\frac{\text{Total weight}}{\text{Tractive effort}} = 5.59$$

Tube heating surface equated to firebox heating surface (Vaughan formula.) ..... 591.8 sq. ft.

Ratio of equated to actual heating surface ..... 1—3.16

*Per cent.

Cost of Ballasting Old Track and Renewing Ties.*

On a northern division of the Chicago & North-Western, to ballast a mile of track with unscreened and unwashed gravel, as it comes from the pit, for a 12-in. raise, with a standard gravel roadbed of 11 ft. 6 in. on the top, slope 1½ to 1 on the bottom, 16 ft. from bottom ballast line to ballast line, the cost is as follows:

Cost of gravel loaded on cars in pit, per cu. yd.	$0.07
Hauling and unloading, 50-mile haul	.10⅔
Ballasting	.12⅓
Total cost, per cu. yd.	$0.30

*A committee report to the Chicago convention of the Roadmasters' and Maintenance of Way Association.

At 3,400 cu. yds. per mile, it will cost $1,020 for one mile of finished work with this kind of ballast.

For tie renewals in this ballast, 425 ties per mile, evenly distributed over the entire mile, where track is in such condition that re-surfacing is not necessary and the old ties have to be dug out of the roadbed and new ties inserted, properly tamping with either tamping bars or picks, the roadbed properly dressed and old ties gathered up and neatly piled, it will cost 16 1/7c. per tie.

On a division of the Lake Shore & Michigan Southern for the year 1906, the cost of ballasting with washed gravel and with broken stone was as follows:

Gravel, washing and loading, per cu. yd.	$0.18
Hauling, per cu. yd.	.07
Digging out old ballast, per cu. yd.	.15
Unloading and placing in track, per cu. yd.	.15
Total per cu. yd.	$0.55
Crushed limestone, ¾ to 1½ in. in size:	
Cost of stone, per cu. yd.	$0.535
Digging out old ballast, per cu. yd.	.15
Hauling, unloading and placing in track	.40
Total, per cu. yd.	$1.085

Renewing ties cost $0.138 per tie in gravel ballast.

On a division of the Santa Fe the cost was:

Crushed stone, at crusher, loaded on cars, per cu. yd.	$0.61½
50-mile haul, per cu. yd.	.05½
Inserting (Mexican labor)	.33
Total cost, per cu. yd.	$1.00

For a 12-in. raise 3,400 cu. yds. are required per mile, making the total cost per mile, $3,400.

This road tried sloping the ballast, with a scant shoulder, for several years, but found it impossible to keep the track in line and surface. It therefore changed to the present standard, which requires the ballast dressed level with the top of the ties for the full length of the tie and extending 6 in. beyond the ends of the ties, making the top width of the ballast 9 ft. and giving it a slope of 1¾ to 1; this gives a roadbed 16 ft. wide from ballast line on one side to ballast line on the other side, with a 12 in. raise. Center-drop Rodger ballast cars, 80,000 lbs. capacity, drop the ballast in center of track and a center plow is used to plow the ballast off the track, leaving the track clear. The $3,400 per mile covers all costs for the ballast and inserting the ties, using not more than 425 ties per mile. It is very expensive work renewing ties in track that has been ballasted in this way. Renewing ties in the track where it is up to grade and cannot be given a raise, costs about 25c. per tie to renew the ties. It costs approximately 25c. to dig out an old tie, insert the new one, tamp it up properly, spike it and dress the track up in first-class shape. Where the track has to be re-surfaced the old tie can be removed and the new one inserted for about 8⅓c. per tie.

The report is signed by A. E. Hansen, Chairman; C. Buhrer, J. W. Guffey.

Automatic Block Signals on the Philadelphia & Western.

The General Railway Signal Company of Rochester, N. Y., which has put in automatic signals on the above named railroad, has issued a description of the apparatus, from which we take the following account. The installation is in many respects like that furnished by the same company for the Electric Zone of the New York Central.

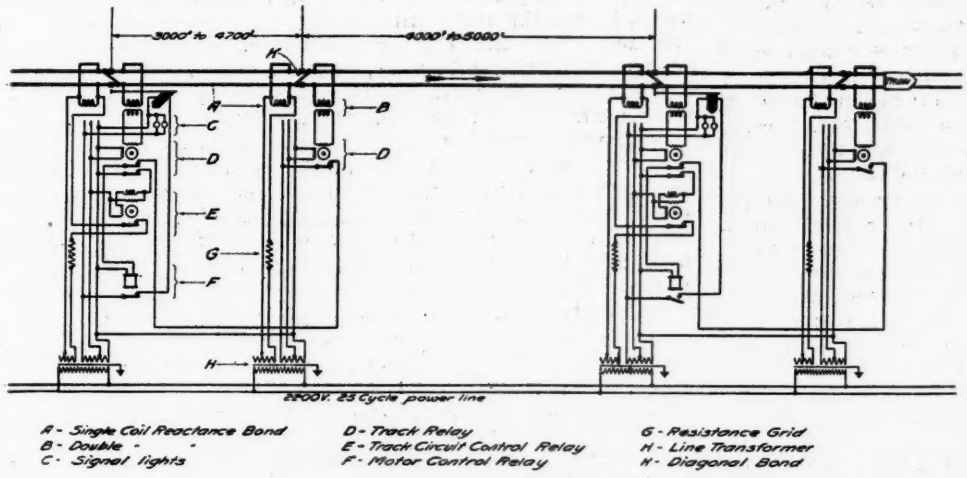


Fig. 1—Circuits.

This road is a double track, high-speed, direct-current electric line from 69th street, West Philadelphia, west to Strafford, Pa., 11½ miles. Both rails of each track are used for the return of the propulsion current and there is cross bonding between all rails of both tracks at the ends of all track circuits and from one rail of each track to one of the other track at some places intermediate between the ends of said sections. Ironless reactance bonds are used, permitting very long track circuits to be operated with a minimum expenditure of energy. Alternating currents are used for the track circuits and for the operation of all the devices connected with the system, thus doing away with all batteries.

There are on the line nine block sections on the eastbound track and nine on the westbound. The four long sections are made up each of two track circuits with relays in the middle.

Single arm, two position home signals are used, arranged normally clear, with an overlap. Between West Philadelphia and Beechwood Park, 2½ miles, the signals average about 3,300 ft. apart and a full block overlap is employed, permitting a two minute time interval. West of the park the signal spacing averages 1½ miles with a uniform overlap of about 3,700 ft., allowing trains to follow one another at five minute intervals.

Twenty-five cycle single phase alternating current is used for the operation of the entire signal system. It is obtained from the secondaries of the railroad company's power transformers at Beechwood Park. Two feeder circuits run in either direction from the power house. Power is delivered to the switch-board through a remote controlled automatic oil switch. Each feeder circuit is equipped with an ammeter and an electrically tripped, hand operated oil switch whereby the system may be relieved in case of a cross on either transmission line. The transmission line consists of two No. 6 B. & S., hard drawn bare copper wires strung on cross arms (used only for these) on the railroad company's high tension pole line. The line is protected at intervals by suitable lightning arresters.

"Line transformers" are installed at all signal and overlap locations. They step down directly from the transmission line voltage of 2,300 to the various voltages required for the signal system. These transformers are protected on the primary side by suitable cartridge fuses mounted in water-tight cast-iron boxes and so arranged that a fuse can be replaced without danger. The secondary windings are three in number, a 55-volt winding for the operation of the signal motors, lights and line relays, and provided with a tap for the local phases of all polyphase relays and two windings for supplying energy to the track circuits, taps being provided on these windings so that the voltage can be varied from 2½ to 15, as required for track circuits of different length. A copper shield is placed between the primary and secondary windings and connected to ground, affording protection in case of a breakdown in insulation. These transformers are made with great care. All coils are insulated with an oil and moisture resisting compound by the "vacuum treatment" process, in which the coils are heated in an air tight tank. After a vacuum has been secured and the moisture thereby extracted, insulating compound is forced into the coil under heavy pressure, which causes the liquid to penetrate to the heart of the coil, with the result that every individual wire is surrounded with a covering of high insulating power.

Both rails of each track are made available for the propulsion current by the use of ironless "reactance bonds" connected to the rails as shown at A and B on the circuit plan, Fig. 1. When so connected they form a path of low ohmic resistance and large current capacity for the traction current, while at the same time they offer an impedance to the passage of the alternating current from rail to rail. The reactance bond A at the transformer end of the track circuit has a single winding connected directly to the rails. The bond B at the other end of the circuit has two windings, one connected to the rails and the other directly to the relay. The winding connected to the relay acts as the secondary of a transformer, its object being to prevent an excessive flow of direct current through the relay which, owing to the low ohmic resistance of the relay, would otherwise result were the relay connected directly to the track rails. As these bonds are of the ironless type they are not subject to saturation due to an unbalanced condition of the traction current in the rails, and their reactance remains constant under all such conditions. Alternate rails in adjacent track circuits are connected by heavy "diagonal bonds" K so arranged that the breaking down of any insulated rail joint will short circuit either the relay or the transformer and prevent the giving of a false clear indication. Cross bonding between tracks may be effected by making connection, at any point desired, to the rails which are made continuous by the diagonal bonds K.

The reactance bonds are made up of flat copper strips of large cross section wound in the form of a spiral, the turns being suitably insulated from each other. The coils when wound are heavily taped and then "impregnated" as in the case of the transformer

coils. These coils are assembled in pairs in flat iron cases and mounted on extended ties. A connecting chamber is provided in the case between the coils in which all the coil ends terminate and where all connections to the rails, relays and transformers are made and then concealed by a suitable cover. The copper connections to the rails after leaving the bonds go directly downward and under ground to the rails where, after passing for a short distance above ground to insure flexibility, they are connected to the rails. This construction conceals the copper as much as possible and reduces theft to a minimum. Energy is supplied to the track circuits directly from the low voltage high current windings on the line transformer through adjustable cast-iron resistance grids which limit the current flow when a train is standing at the transformer. These grids are mounted in separate perforated cast-iron boxes.

The track relays are shown at D. The various moving contacts are mounted on a horizontal wooden bar to which motion is imparted by means of a small split phase induction motor having two stationary windings. One winding is connected directly to the reactance bond secondary, as shown in Fig. 1, and the other directly to a low voltage tap on the line transformer. When thus connected, a phase difference exists between the two coils and rotation of the armature is thereby produced.

Of the energy in the two relay windings, that supplied by the transformer direct is by far the greater. This requires but a small amount of energy from the track to give positive action of the relay and as a result very long blocks can be operated with a comparatively small amount of energy, as evidenced by the fact that track circuits 8,800 ft. long are operated with energy fed in at one end. Alternating current only can cause the relay to operate and hence it is absolutely immune to the effects of direct current. All contacts and other working parts are made visible by means of glass covered openings, and the case is made water tight by the use of rubber gaskets. These relays are thoroughly reliable, positive in action and give an exceptionally heavy rubbing pressure between the contacts in closing and an extra wide opening when de-energized. Contacts can be provided, as required, up to a maximum of four front and four back per relay. They are insulated to withstand a breakdown pressure of 3,000 volts alternating.

The function of the track circuit control relays, as shown at E, is to hold a given signal at stop until the train is out of the overlap for the next signal in advance. These relays have to carry continuously and break the entire current flowing to the track circuit at the rear of a signal, and of course must continue to do so without injury. They will actually carry an alternating current of from 50 to 75 amperes and break the same at 25 volts continuously without overheating and without perceptible arcing; but the current required to be carried in practice is much less than this. The construction and operation of these relays is similar to that of the track relays except that the contacts are made very much heavier and the necessary phase displacement to produce rotation is effected by a small reactance coil, placed in series with one of the relay windings.

Polyphase relays can be adapted to a variety of uses by the mere changing of the windings or contacts or by the addition of stock parts. When wound to a low resistance they may be used as track relays with contacts to the number of four front and four back, and when equipped with heavy contacts they can be used for the control of low voltage heavy currents, all as described above. When equipped with carbon to carbon contacts they will break small currents of high voltage (up to 600). When wound to a high resistance they may be used as line relays with any reasonable equipment of contacts desired. By adding an upward extension to carry a miniature semaphore arm they can be used as tower indicators and, when placed in a suitable case, as switch indicators.

The movements when placed in a suitable case and equipped with a shutter and suitable contacts can be used as light signals in tunnels. Furthermore, the feature which this relay possesses of operating in one direction with a given phase relation and in the opposite direction when said phase relation is reversed, and since a given reactance or resistance is necessary to produce rotation in a given direction, the possibility of false operation due to foreign currents or crosses is much more remote than in the case of direct current relays and other designs of a. c. relays. This feature also makes it possible in many cases to use but one line wire where two would otherwise be required.

The motor control relay shown at F is controlled by the three track circuits in advance of a given signal in such manner that it cannot close until the train is out of the overlap for the next signal in advance. This relay directly controls the clearing of the signal and is of the alternating current tractive type. It is so designed that a uniform magnetic pull is exerted on the armature notwithstanding the fact that the current in the magnetic coils alternates.

The signal mechanism is operated by a small single phase induction motor which is connected through suitable gearing to a "slot wheel." Projecting from the sides of the slot wheel are pins which as they come around engage the "slot dog" so as to clear the signal in case the slot is energized.

The slot magnet is designed to operate on alternating current and to give a uniform pull without noise or vibration. It has a high "drop away" point.

The movement of the blade in clearing is limited by the "stop arm." The arm is brought precisely to, and held at, the clear position no matter what the speed of clearing. The circuit breaker contacts are enclosed in a dust proof case with a glass front, which is mounted at the top of the mechanism. The dash pot is of the "buffer type," allowing a free initial movement of the blade in returning to the stop position. All signals are lighted by two 4 c.p., 50-volt lamps in multiple. All relays are housed in wooden boxes which in turn are enclosed in cast-iron boxes.

Keeping Track in Line and Surface in the Winter.*

I know track, laid upon a sub-grade of deep uniform red clay, which heaves high in the winter, but requires very few shims because the heaving is uniform. This material heaves excessively, as is proven by the fact that it rises at the ends of a spot where some special cause dries the clay and reduces the quantity of moisture which it contains. For instance: A large steam pipe was carried in a box under the track where the soil was of this kind. The heat from the pipe prevented heaving at that point, but on each side of it the track rose several inches above the level of the ties over the pipe, making an abrupt drop in surface over the latter spot. This spot was shimmed every winter, as the difference in height was sudden and severe enough to break an engine frame or cause other damage. When the frost came out of the ground in the spring the level of the track on each side of the pipe gradually subsided until it was the same as that over the pipe; when this occurred the shims were withdrawn. The thickness of the shims was gradually increased while the frost was entering the ground, and reduced while it was leaving.

In territories where the soil varies greatly in character—sandy, gravelly, various kinds of clay and loams, marshes, quick-sand, wet and dry cuts, springy soil, etc.—much shimming is required. In January, February and March frost enters the ground to a depth of from 3 to 6 ft. and maintenance of line and surface becomes difficult. In such territories it is a common thing for 5 or 6 ft. of track to rise, in a single day or night, 1 or 2 in. above the normal level. It is not uncommon to have a continued rise within a distance of 10 or 15 ft. that will, in a few days, reach a maximum of 5 or 6 in.

Of course, it is out of the question to run trains safely at schedule speed over such abrupt and excessive humps. Gradual run-offs must be introduced on either side of the high spots. But the ties being frozen solidly in place and the ballast frozen so solidly together that it can only be picked in irregular sized hard lumps unsuitable for surfacing, it is manifest that making a run-off as it would be done in summer is both impracticable and expensive. Again, when spring arrives this would make soft, mushy spots at the worst period of the year's work. The ties, if adzed to reduce the height of the rails at the point of heaving, would be ruined. So, in such cases it is customary to raise the run-off by drawing the spike on each side of the high spot, letting the rails spring up part way to surface, then introducing shims between the rails and the ties until a run-off of fairly uniform surface is provided. The rails then being raised, as it were, upon pedestals, are not so strongly held to gage as when resting upon the ties and are braced on the outside with special braces, usually devised by the foreman or roadmaster to fit the individual case.

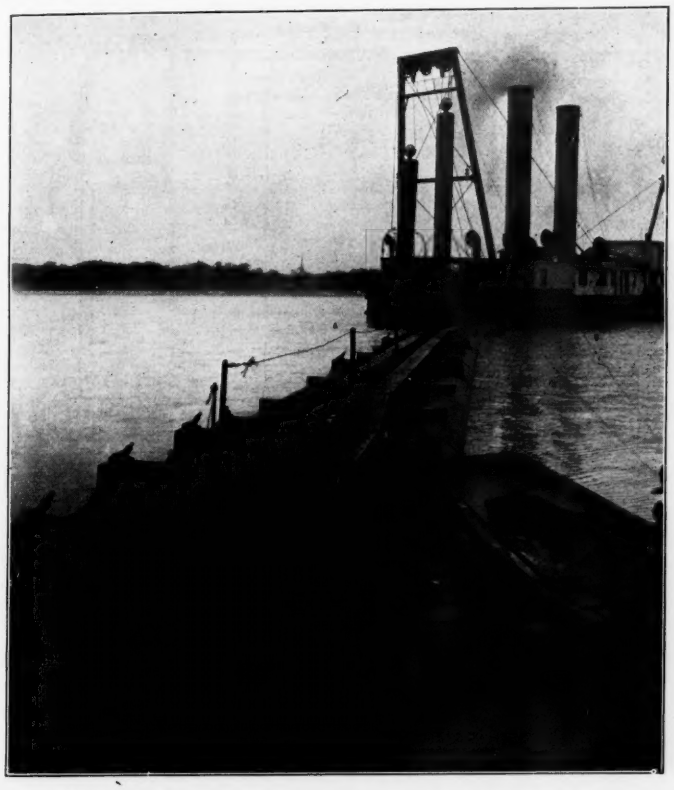
Shims are sawed from hard wood, seasoned and clear. They are bored with holes for the spikes, which are staggered, there being sometimes two holes, sometimes four, to fit different widths of rail base. For shimming to a raise of ¼ in. the shims should be 4½ in. x 8 in.; for a raise of ½ in. up to 1¾ in. the shim should be 5 in. x 8 in. Above that height, up to 3 in., the shim should be 5 in. x 12 in. When necessary to shim 4 in. or higher a plank of about the same area as the surface of the tie, and extending almost or quite the length of the tie, should be used, fastened to the tie with boat spikes. The rails should be spiked through the shims to the ties with 8-in. spikes, which are longer than ordinary track spikes. For the planks referred to, they should be 8 in. long, or 2½ in. longer than ordinarily. To brace the rails on shims cut a light notch outside of the rail transversely across the tie, put a shim 2 or 3 in. thick with one end against the shoulder of the notch and the other a close fit at the fillet where the head and web of the rail meet, and drive 8-in. spikes into the tie at the lower end of this makeshift brace.

The foregoing has reference to ways and means to do things that it really ought not to be necessary to do. In other words, these are ways of meeting conditions that ought not to exist. The better way to maintain line and surface in winter is by proper drainage.

*A report presented to the Roadmasters' and Maintenance of Way Association by C. H. Cornell, Roadmaster of the Ashland Division of the Chicago & North-Western.

A Large Hydraulic Dredge.

The dredge illustrated herewith is a large and powerful machine built to the order of the Commissioners of Lincoln park, Chicago, to be used for filling in the new park extension to the north of the present park. The plan is to reclaim from Lake Michigan an area approximately 1,500 ft. wide by about a mile long by enclosing it with a stone revetment or breakwater and filling in behind it with



Hydraulic Dredge Francis T. Simmons, at Work.

material taken from the bed of the lake. For much of the distance the breakwater lies in 18 ft. of water and the total volume of fill is about 4,000,000 cu. yds. The breakwater is now partly completed and is made of stone from the spoil-banks of the Chicago drainage canal. A fleet of large scows and several powerful tugs bring the stone from the canal by way of the Chicago river out into the lake and to the site of the work.

The conditions surrounding the dredging and filling were difficult and peculiar. The work had to be done in deep water and exposed to the storms of Lake Michigan, which often rise with suddenness and severity, and the soil to be dredged consisted of the tough blue clay which underlies the Chicago area, compacted by the storms of the lake and mixed with more or less gravel and stones. The ordinary hydraulic dredge as used on the lakes was unsuitable because of unseaworthiness and because it could only deal effectively with soft material. The usual floating pipe-line connected by rubber sleeves and mounted on a number of small scows or floats would be disabled by every windstorm.

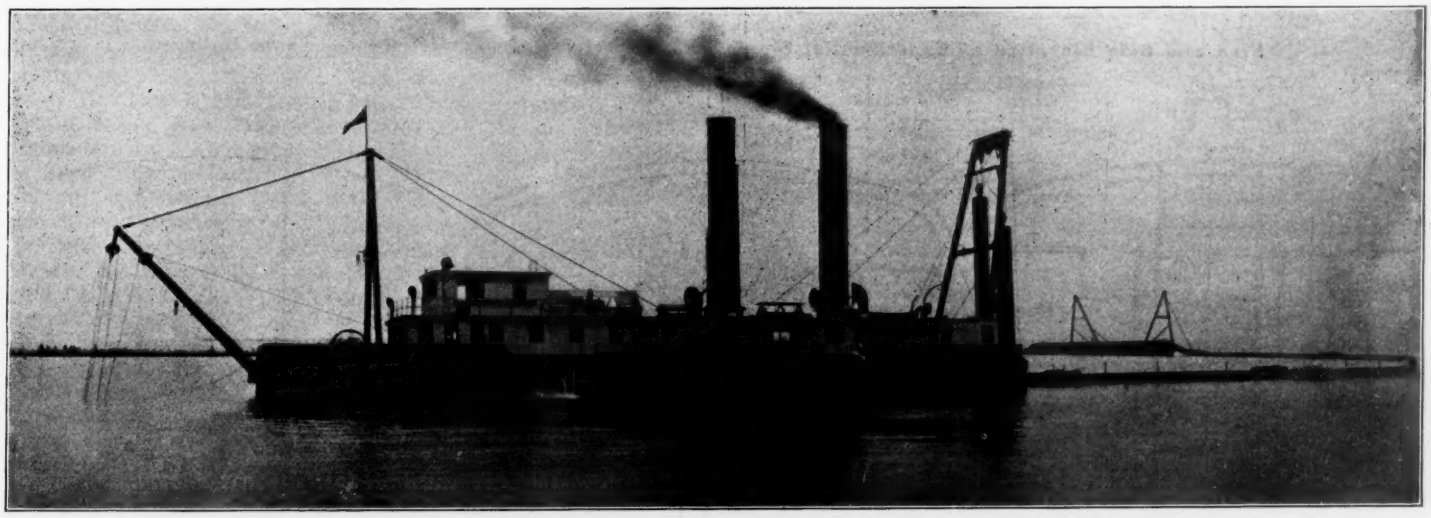
The economy of the hydraulic process of dredging and filling, if it could be successfully applied, led Francis T. Simmons, President, and R. H. Warder, Secretary, of the Park Commission, to pursue the subject further to see if these difficulties could be overcome, and they commissioned A. W. Robinson, M. Am. Soc. C. E., to examine and report on the conditions, and if possible to design a dredge that could cope with the difficulties presented. Mr. Robinson had previously designed and built several large hydraulic dredges, notably the "Tarte," which is employed in dredging clay from the bed of Lake St. Peter in the River St. Lawrence, and which is provided with a special pipe-line for withstanding heavy storms. This dredge is of great power and holds the world's record for output, having dredged 750,000 cu. yds. in a calendar month and delivered 2,000 ft. The original pipe-line of this dredge is still in use after five years.

It was, of course, realized that Lake Michigan during a storm would be too rough to attempt continuous dredging operations, and that the most that could be done would be to provide a plant of large capacity, so that the required output could be made after making allowances for weather interruptions, and also seaworthy enough to increase the working time to the largest possible amount. It should also be designed for safe and rapid picking up of anchorages and pipe-line in case of storm and to safely withstand any rough weather when not working. To meet these conditions Mr. Robinson designed the dredge now on the work, which was built by the Atlantic Equipment Company, 111 Broadway, New York, and put in service in June, 1907.

The hull is of steel, 148 ft. long, 38 ft. wide by 10 ft. 6 in. deep. The main pump has 30-in. suction and discharge, and the main engines are of the triple-expansion marine type of 1,200 i.h.p. There are two double-ended marine boilers 11 ft. 6 in. diameter by 18 ft. long, with eight corrugated furnaces. The installation of engine-room auxiliaries, such as condensing apparatus, pumps, electric light, is complete and well arranged, the engine-room space, in fact, resembling a small ocean liner. On the upper deck is a pilot-house with large plate-glass windows, where all the levers which control the operation of the dredge are arranged. Here are also pressure and vacuum gages for all purposes, indicating exactly the work that is being done.

The suction-pipe is carried by a very strong steel frame and is fitted with a powerful cutter for digging the clay. This cutter is an improved development of a number of earlier machines, and has demonstrated its efficiency by being able to handle the heaviest clay up to the full capacity of the pump. It is 9 ft. in diameter and weighs about nine tons, being formed of eight steel blades of peculiar curvature cast in one piece and having renewable hard steel cutting edges attached. The mechanism for driving and feeding this cutter is very powerful. The secret of success of this dredge is that the excavation of the stiff clay is done by an efficient cutting tool that will not clog and provided with a powerful feed, the main pump being only employed for transportation of the spoil. A capacity rate of 3,000 cu. yds. per hour has frequently been reached in clay, the entire under side of the discharge appearing as continuous slices of blue clay, some of the pieces being 4 or 5 ft. long.

One of the most difficult problems to be dealt with was the floating pipe-line. This is the most seaworthy pipe-line on the lakes, and is formed of semi-submerged steel pontoons about 100 ft. long, connected by ball-and-socket joints having spring connections of great strength. Long lengths of pontoon were necessary to give steadiness in waves, and a yielding connection was essential to relieve the joints of the great stresses due to surging. The springs are of locomotive drawbar size and are arranged in a manner similar to railroad car draft-rigging. There are also tension and compression springs to control the side deflection of the joint. In wave action this pipe-line is very satisfactory. A special flange connection is provided at the dredge, so that the pipe-line can be instantaneously disconnected from the dredge at any time by pulling out a toggle-lever. On several occasions when it became too rough for the



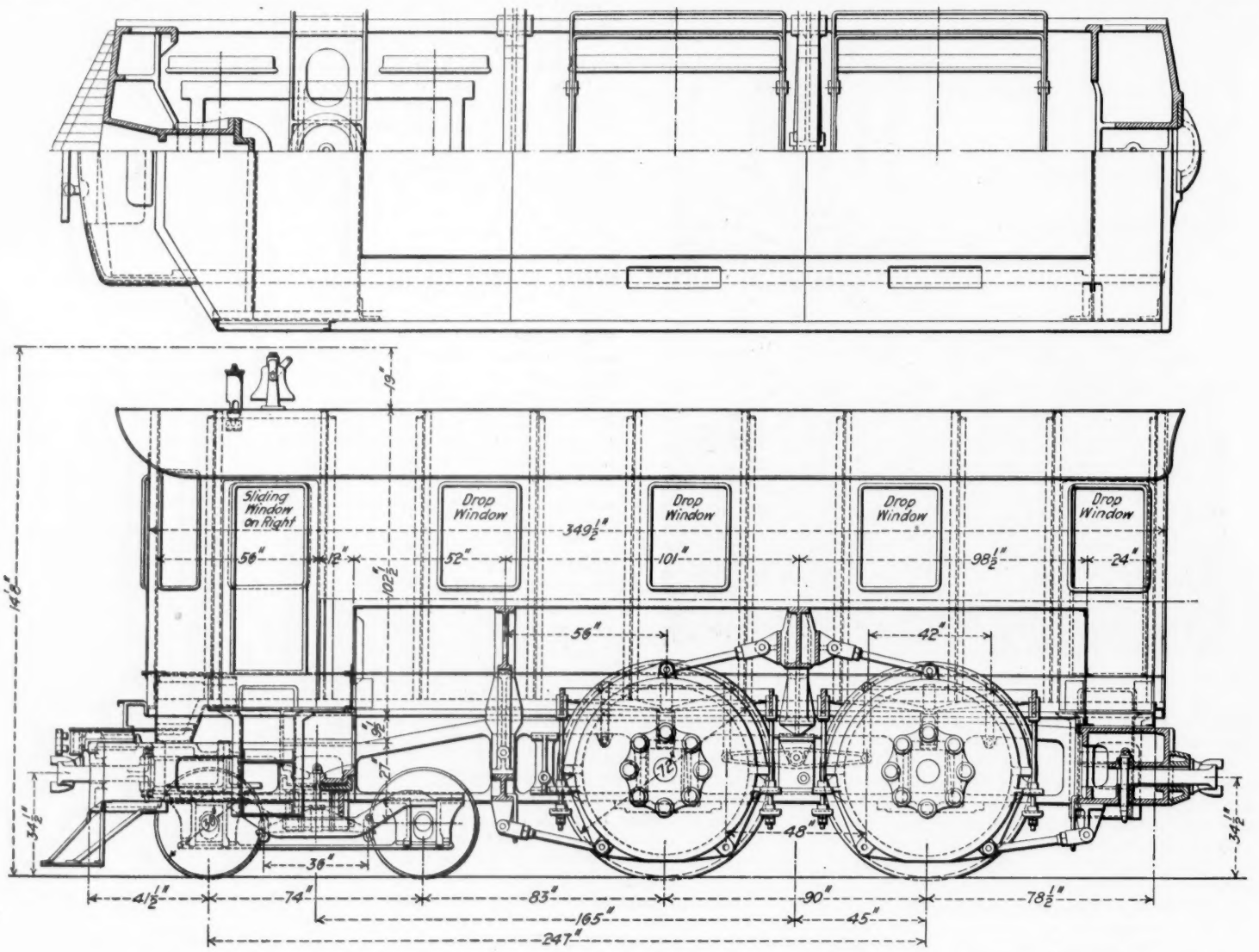
Hydraulic Dredge Francis T. Simmons, Built by Atlantic Equipment Company for Lincoln Park Commissioners, Chicago.

dredge to work, owing to the difficulty of discharging over the breakwater, the pipe-line was discontinued and towed to harbor by a tug through a rough sea which broke over both tug and pipes continuously, with no harm whatever to the pipe-line. These occasions, however, are relatively rare, and the operation of the dredge has proved not only that the clay of the bed of Lake Michigan can be dredged by this method, but also that the seaworthiness of both dredge and pipe-line is sufficient to reduce the delays on account of weather to a comparatively small amount.

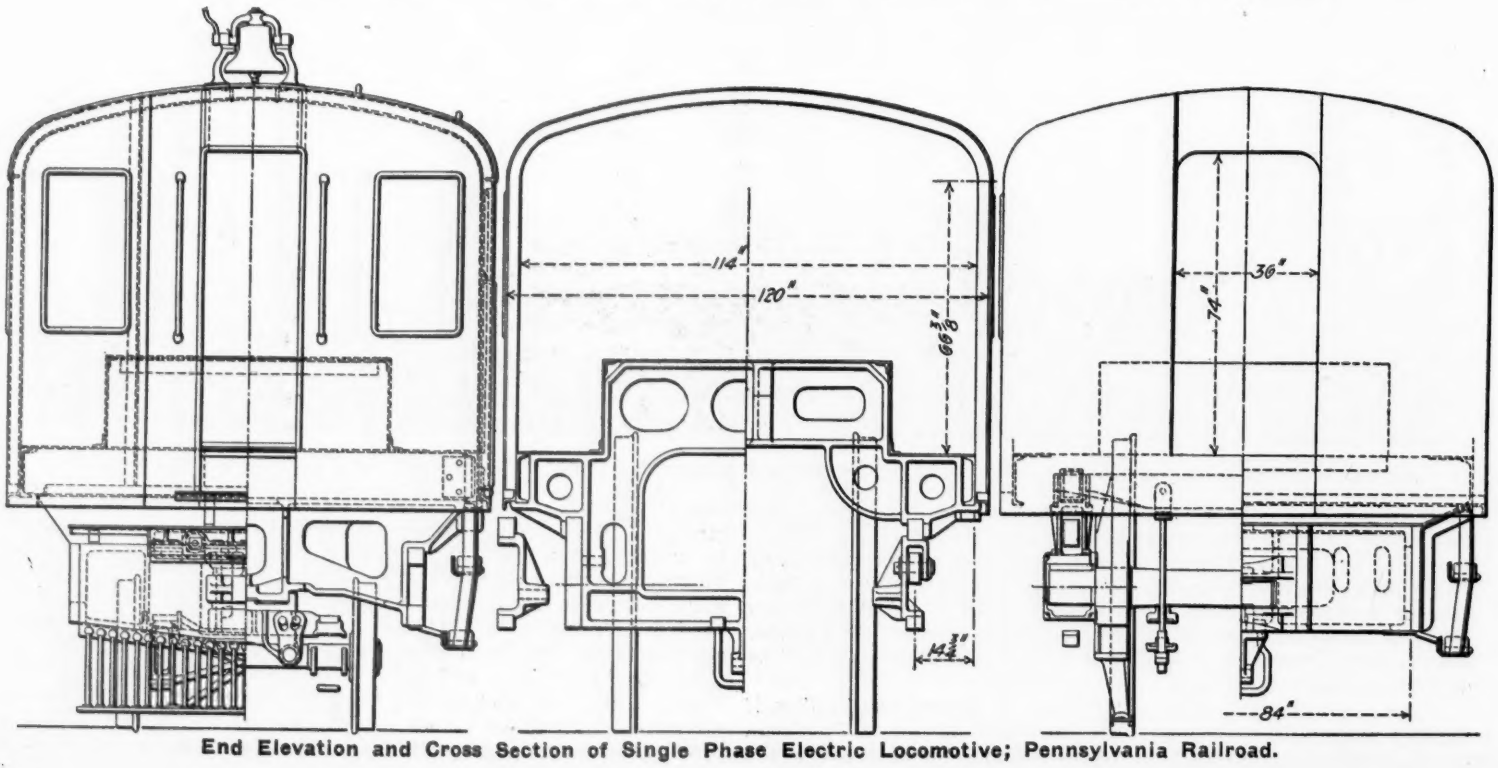
The dredge is named the "Francis T. Simmons," and its operation is in charge of Murphy & Barrett, contractors.

Electric Locomotive for the Pennsylvania Railroad.

The Pennsylvania is now testing, on the West Jersey & Seashore division, three electric locomotives with a view to determining the track stresses and other questions in heavy electric traction. One of these, No. 10,001, built at Altoona, is a single-reduction,



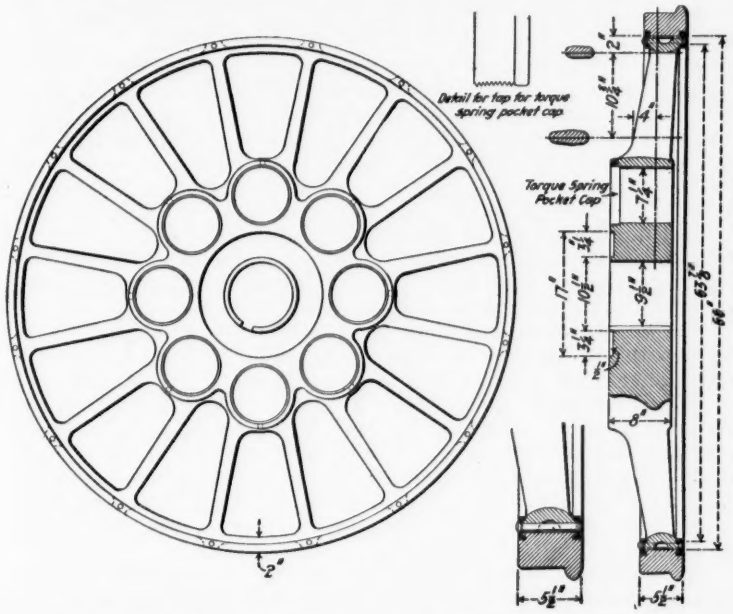
Plan and Side Elevation of Experimental Single Phase Electric Locomotive; Pennsylvania Railroad.



End Elevation and Cross Section of Single Phase Electric Locomotive; Pennsylvania Railroad.

direct-current geared type; another, No. 10,002, built at Altoona, is direct-current gearless; the third, No. 10,003, built by the Baldwin Locomotive Works, is alternating-current gearless, and is shown in the drawings herewith. This Baldwin design is intended as a unit, one-half of an articulated locomotive adapted to handle a 400-ton passenger train, but complete in itself.

It is interesting to note that, in the development of the electric



Driving Wheel of Single Phase Electric Locomotive.

locomotive, comparatively little attention has been paid to the experience of steam locomotive builders, and many provisions that these designers consider essential to satisfactory operation have been ignored. The electric locomotive has been looked upon merely as a vehicle on wheels, all of which could be used for driving purposes, and it has, therefore, apparently followed the lines of the street car design, from which it was directly evolved rather than those of the steam locomotive which it is intended to supplant. The axles are set in the frame and the wheel arrangement resembles that of European locomotives in the absence of the leading truck.

The truck has been characteristic of and considered a necessity for the American engine since the early days, but was very slow in gaining recognition and adoption abroad. The design for the New York Central electric locomotives included a two-wheeled truck at each end, and then, after the Woodlawn derailment of last winter, a four-wheeled truck was put upon one locomotive for experimental purposes. The New York, New Haven & Hartford locomotive, on the other hand, is merely a short, heavy car carried on two bogie trucks. This engine should evidently have the same flexibility of motion as an ordinary double-truck motor car.

An entirely different view of the problem has evidently been taken in the latest design of electric locomotive built for the Pennsylvania Railroad by the Baldwin Locomotive Works, which is now being tested on the West Jersey & Seashore. In this electric locomotive the wheel arrangement of the American (4-4-0) has been followed; an arrangement that was so long and so successfully used in high-speed passenger service, and afterwards amplified for heavy trains by the addition of a third pair of driving wheels, making the ten-wheel type. Not only has this novel wheel arrangement for electric locomotives been adopted, but the diameter of the driver has been increased to 72 in., and it only remains now to increase it still further to 80 in. to parallel the standard Pennsylvania construction. As it is, the center of gravity has been carried to as great a height as possible with this diameter of wheel, and it is thought that, as it stands, it can be coupled to any number of locomotives of the same character without any danger of the engine buckling or pushing the track out of place.

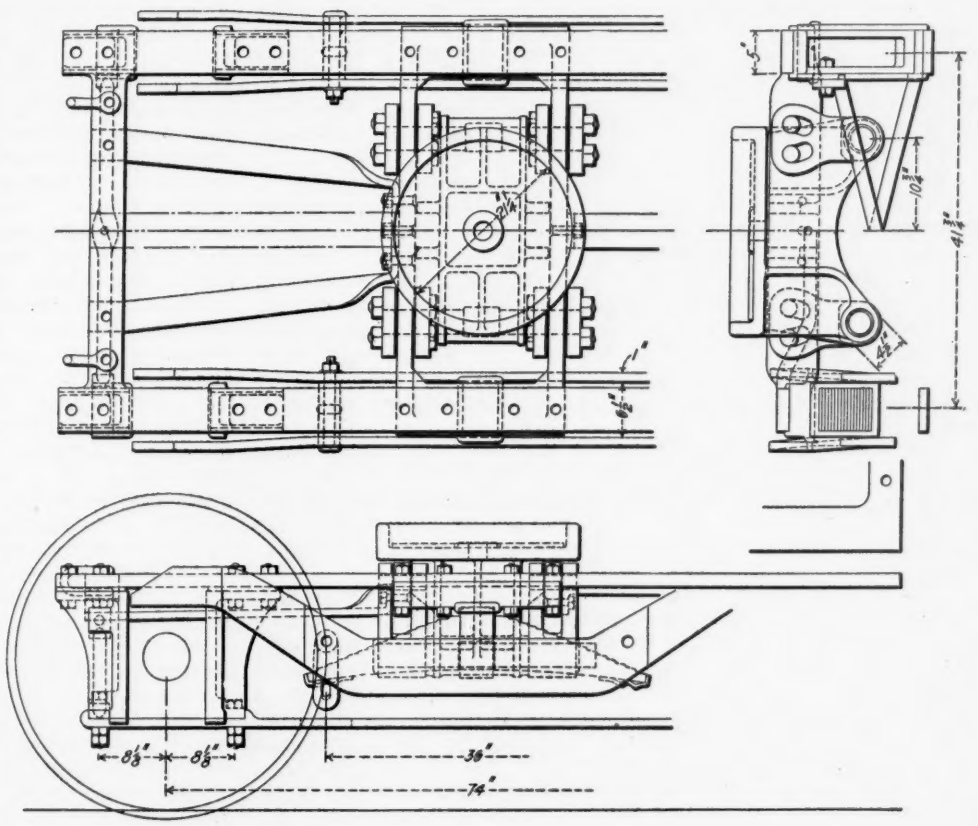
It is claimed that, inasmuch as a certain diameter of driving wheel is needed in order that the steam locomotive may be run successfully without undue heating, the same rule should hold true for the electric locomotive, or else that much less should be expected of it.

It will be noticed that almost all of this locomotive is above the springs and that even the armatures themselves are supported by springs of a peculiar design inserted in pockets in the driving wheel center. In this particular it resembles the New York, New Haven & Hartford engine which was illustrated in the *Railroad Gazette* April 13, 1906. At that time, half-tone reproductions of photographs were used to illustrate the wheels and quill with its bosses that enter the pockets. A detail drawing of the wheel is shown here from which a clear idea of its construction can be obtained. With this arrangement the armature is not placed directly on the axle but is built up on a quill through which the axle passes with a small clearance all around. The bearings which carry the field frame are mounted on this quill and from a flange at each end of the quill round pins project parallel to the axle into the pockets in the driving wheel. The torque of the motor is transmitted from these pins to the wheel through helical steel springs which are wound with their turns progressively eccentric, and which are contained between two steel bushings, the smaller of which slips over the pins, and the larger fits in the pocket of the wheel. These springs are under compression both longitudinally and horizontally so that, at all times, they fill the sockets in the wheel but permit a vertical and lateral motion.

With the heavy armatures thus provided with a spring suspension the frame and superstructure is carried in exactly the same manner as in its prototype, the 4-4-0 steam locomotive. That is to say, the weight on the driving wheels is equalized between the two with semi-elliptic springs over the driving boxes and an equalizing lever between.

As in the case of other electric locomotives, advantage is taken of the absence of rods to use outside bearings.

The truck resembles the ordinary four-wheeled truck. The load is carried on a center-plate of large diameter and ample depth of pocket, and this forms a part of the bolster which rests upon inverted semi-elliptic springs at each side, suspended between flat equalizers by which the weight is transferred to the boxes. With the long wheel base of 74 in. that is given to the truck the danger of flange binding should be entirely obviated and the action should closely resemble that of the standard 4-4-0 locomotives. Already speeds of 60 miles an hour have been obtained in the experimental work that has been undertaken.



Leading Truck; Pennsylvania Railroad Single Phase Electric Locomotive.

The principal dimensions and data relating to the locomotive are as follows:

Weight, total	140 tons
" on each of the four drivers	50,000 lbs.
" on each of the two pony trucks	40,000 "
" on each motor	19,500 "
Diameter of drivers	72 in.
Diameter of pilot wheels	36 "
Wheel base, total (half locomotive)	20 ft. 7 in.

Wheel base, rigid	7 ft. 6 in.
" pony truck	6 " 2 "
Length over bumpers (half locomotive)	31 " 0 "
Height of locomotive	13 " 4 "
Width of locomotive	10 " 0 "
Number of motors per locomotive	4
H.p. of each motor (one hour rating)	500
" " " " (maximum)	800
" " " " (cont. cap.)	375
" " " locomotive (maximum)	3,200
Tractive effort of locomotive (maximum)	40,000 lbs.
" " " " (at 1-hr. rating)	14,700 "
" " " " (at cont. cap.)	9,200 "
Speed, miles per hr. (at 1-hr. rating)	51
Speed, miles per hr. (at con. rating.)	61
Voltage on trolley	11,000
Voltage on each motor	275

Massachusetts Law Requiring Carriage of Public School Pupils at Half Price.

The Supreme Court of the United States, in an opinion prepared by Justice Holmes, has affirmed the judgment of the Superior Court of Massachusetts sustaining a law of that state requiring street railroads to carry public school pupils at half fare. The suit was brought by the Interstate Consolidated Street Railway Company. The decision in substance follows:

This was a complaint against the plaintiff in error for refusing to sell tickets for the transportation of pupils to and from the public schools at one-half the regular fare charged by it, as required by Mass. Rev. Laws, c. 112, Sec. 72. At the trial the railway company admitted the fact, but set up that the statute was unconstitutional, in that it denied to the company the equal protection of the laws and deprived it of its property without just compensation and without due process of law. In support of this defence it made an offer of proof which may be abridged into the propositions that the regular fare was 5 cents; that during the last fiscal year the actual and reasonable cost of transportation per passenger was $3^{86}/_{100}$ cents, or, including taxes, $4^{10}/_{100}$ cents; that pupils of the public schools formed a considerable part of the passengers carried by it, and that the one street railway expressly exempted by the law transported nearly one-half the passengers transported on street railways and received nearly one-half the revenue received for such transportation in the Commonwealth. The offer was stated to be made for the purpose of showing that the plaintiff in error could not comply with the statute without carrying passengers for less than a reasonable compensation and for less than cost. The offer of proof was rejected, and a ruling that the statute was repugnant to the Fourteenth Amendment was refused. The plaintiff in error excepted and, after a verdict of guilty and sentence, took the case to the Supreme Judicial Court; 187 Mass. 436. That court overruled the exceptions, whereupon the plaintiff in error brought the case here.

This court is of opinion that the decision below was right. A majority of the court considers that the case is disposed of by the fact that the statute in question was in force when the plaintiff in error took its charter, and confines itself to that ground. The act of incorporation went into effect March 15, 1901. The plaintiff in error was "subject to all the duties, liabilities and restrictions set forth in all general laws now or hereafter in force relating to street railway companies, except," etc. * * * The contents of a document may be incorporated or adopted as well by generic as by specific reference, if only the purport of the adopting statute is clear.

Speaking for myself alone, I think that there are considerations * * * that made it unsafe not to discuss the validity of the regulation apart from the supposition that the plaintiff in error has accepted it. Therefore I proceed to state my grounds for thinking the statute constitutional irrespective of any disabilities to object to its terms.

The discrimination alleged is the express exception of the Boston Elevated Railway Company and the railways then owned, leased or operated by it. But, in the first place, this was a legislative adjudication concerning a specific road, not a general prospective classification. A general law must be judged by public facts, but a specific adjudication may depend upon many things not judicially known. Therefore the law must be sustained on this point unless the facts offered in evidence clearly show that the exception cannot be upheld. But the local facts are not before us, and it follows that we cannot say that the legislature could not have been justified in thus limiting its action. In the next place, if the only ground were that the charter of the Elevated Railway contained a contract against the imposition of such a requirement, it would be attributing to the Fourteenth Amendment an excessively nice operation to say that the immunity of a single corporation prevented the passage of an otherwise desirable and wholesome law. It is unnecessary to consider what would be the effect on the statute by construction in Massachusetts if the exception could not be upheld. For, if in order to avoid the Scylla of unjustifiable class legislation, the law were read as universal, it might be thought by this court to fall into the Charybdis of impairing the obligation of a contract with the elevated road, although that objection might perhaps be held not to be open to the plaintiff in error here.

The objection that seems to me, as it seemed to the court below, most serious is that the statute unjustifiably appropriates the property of the plaintiff in error. It is hard to say that street railway companies are not subjected to a loss. The conventional fare of 5 cents presumably is not more than a reasonable fare, and it is at least questionable whether street railway companies would be permitted to increase it on the ground of this burden. It is assumed by the statute in question that the ordinary fare may be charged for these children or some of them when not going to or from school. Whatever the fare, the statute fairly construed means that children going to or from school must be carried for half the sum that would be reasonable compensation for their carriage, if we looked only to the business aspect of the question. Moreover, while it may be true that in some cases rates or fares may be reduced to an unprofitable point in view of the business as a whole or upon special considerations, it is not enough to justify a general law like this, that the companies concerned still may be able to make a profit from other sources, for all that appears.

Notwithstanding the foregoing considerations I hesitatingly agree with the state court that the requirement may be justified under what commonly is called the police power. The obverse way of stating this power in the sense in which I am using the phrase would be that constitutional rights like others are matters of degree and that the great constitutional provisions for the protection of property are not to be pushed to a logical extreme, but must be taken to permit the infliction of some fractional and relatively small losses without compensation, for some at least of the purposes of wholesome legislation.

If the Fourteenth Amendment is not to be a greater hamper upon the established practices of the states in common with other governments than I think was intended, they must be allowed a certain latitude in the minor adjustments of life, even though by their action the burdens of a part of the community are somewhat increased. The traditions and habits of centuries were not intended to be overthrown when that amendment was passed.

Education is one of the purposes for which what is called the police power may be exercised. Massachusetts always has recognized it as one of the first objects of public care. It does not follow that it would be equally in accord with the conceptions at the base of our constitutional law to confer equal favors upon doctors, or workingmen, or people who could afford to buy 1,000-mile tickets. Structural habits count for as much as logic in drawing the line. And, to return to the taking of property, the aspect in which I am considering the case, general taxation to maintain public schools is an appropriation of property to a use in which the taxpayer may have no private interest, and, it may be, against his will. It has been condemned by some theorists on that ground. Yet no one denies its constitutionality. People are accustomed to it and accept it without doubt. The present requirement is not different in fundamental principle, although the tax is paid in kind and falls only on the class capable of paying that kind of tax—a class of quasi public corporations specially subject to legislative control.

Thus the question narrows itself to the magnitude of the burden imposed—to whether the tax is so great as to exceed the limits of the police power. Looking at the law without regard to its special operation I should hesitate to assume that its total effect, direct and indirect, upon the roads outside of Boston amounted to a more serious burden than a change in the law of nuisance, for example, might be. Turning to the specific effect, the offer of proof was cautious. It was simply that a "considerable percentage" of the passengers carried by the company consisted of pupils of the public schools. This might be true without the burden becoming serious. I am not prepared to overrule the decision of the Legislature and of the highest court of Massachusetts that the requirement is reasonable under the conditions existing there, upon evidence that goes no higher than this. It is not enough that a statute goes to the verge of constitutional power. We must be able to see clearly that it goes beyond that power. In case of real doubt a law must be sustained.

Mr. Justice Harlan is of opinion that the constitutionality of the Act of 1900 is necessarily involved in the determination of this case. He thinks the act is not liable to the objection that it denies to the railway company the equal protection of the laws. Nor does he think that it can be held, upon any showing made by this record, to be unconstitutional as depriving the plaintiff in error of its property without due process of law. Upon these grounds alone, and independent of any other question discussed, he joins in a judgment of affirmance. Judgment affirmed. Mr. Justice Moody, having been of counsel, did not sit in this case.

The plans for the Rove tunnel through which the canal from Marseilles to the Rhone is to pass have been approved. While not the longest tunnel in the world, it will have the largest cross-section of any. Its length will be 4⅓ miles, width 72 ft., height

46¼ ft., and the total cubic contents twice that of the Simplon tunnel. On either side there will be a 6½-ft. roadway for an electric railway. The cost is estimated at $6,900,000, and the time required for its construction seven years.

Car Efficiency Reports.

The Committee on Car Efficiency of the American Railway Association has issued its statement of freight car balance and performance for June, 1907, Bulletin No. 10. The introduction gives the principal results as follows:

This Bulletin is more nearly representative than any previous issue, comprising reports from roads with an aggregate mileage of 211,314, and a total of 2,014,069 cars in service.

The car situation during June was, in general, much easier than at any previous time during the current year. The home movement of foreign cars continued until the average home cars in service during this period was 57 per cent. as against 54 per cent. and 55 per cent., respectively, in April and May; the per cent. of foreign cars utilized dropping from 44 per cent. and 43 per cent. in April and May to 41 per cent. in June. As a rule this condition would result in a decrease in loaded mileage. However, during June the shortages were still general enough to permit of the handling of the homeward movement of foreign cars with a minimum of empty mileage. As a consequence the per cent. of "loaded mileage" shows a slight improvement.

There is a slight falling off in the "average miles per car per day" as compared with May, and also in the "average ton miles per car per day," with a corresponding drop in the "average earnings per car on line."

Possibly the most gratifying feature of this report is the increase in "average tons per loaded car" from 19.8 in April and May to 20.4 in June. This item has shown a gradual increase since our first compilation, including tonnage figures (July-December, 1906), which is indicative of partial success in the efforts being made to reduce the wide margin between average loading and average capacity.

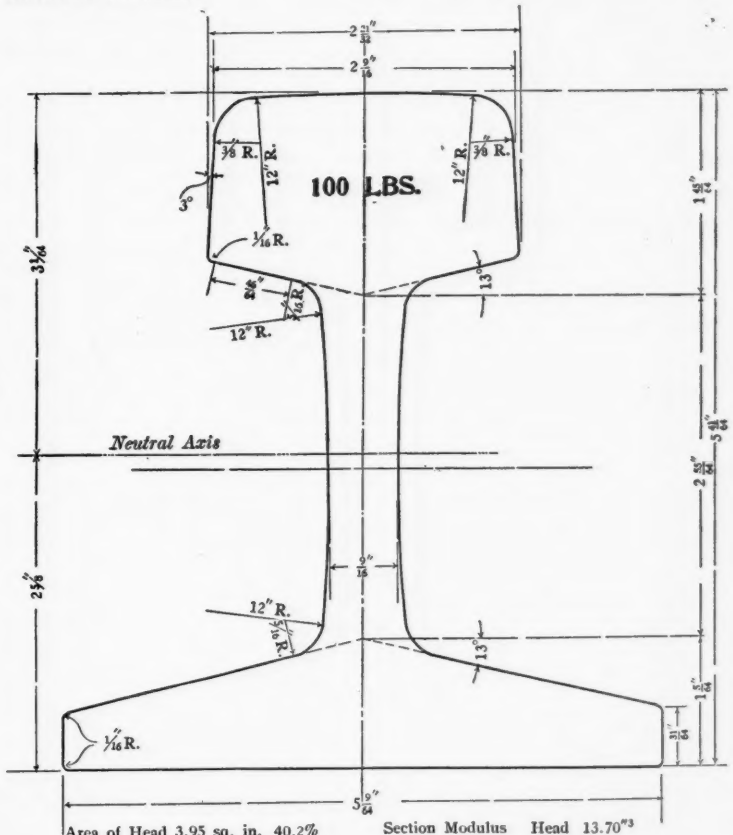
The increase in average capacity by building large cars is in the direction of economy, but to secure the full benefit of this economy it is essential that the increased capacity be fully utilized. With the exception of coal, ore and a few other dense commodities, it is doubtful if the average loading of cars has followed the increase in capacity. Roughly, the proportion of capacity utilized is about 60 per cent. Considering that approximately 64 per cent. of the tonnage of the country consists of coal, ore and other heavy commodities which should average close to 100 per cent., it is obvious that the loading of the lighter commodities falls far short of the capacity. Of the numerous causes for this condition, some are beyond the control of the railroads, but there are many which can be remedied by systematizing the loading and giving it proper supervision.

The handling of L. C. L. shipments especially is attended with considerable waste of capacity, and on railroads where this matter has been given close attention, a great deal has been accomplished in the way of improving not only the loading but the movement of L. C. L. business. The minimum loading provided by the various freight classifications also has a marked bearing on the utilization of car capacity. While the average capacity of freight cars has increased approximately 40 per cent. during the past few years, there has been little change in the classifications as regards minimum loading. The recent revision of the official classification increased the minimum on a number of commodities, which action should have a good effect in the territory covered by the change. A movement is under way for the adoption of one classification for the entire country. The proposed consolidation would undoubtedly have a beneficial effect on car efficiency, provided the question of minimum loading is given the consideration which its importance warrants.

The committee has issued Bulletin No. 9, showing car surpluses and shortages on October 16 and October 30, the number of roads reporting on the 16th being 162 and the number on the later date only two less. The shortages have reached the maximum since last winter. The shortage of stock cars in the West was severe in the first part of October, but was much improved at the end of the month. The aggregate of the shortages October 16 was 85,764, while on the 30th it was 90,757. West of Chicago the shortages were considerably smaller on the 30th, but in the eastern, central and southern states they were decidedly larger, making a net increase of about 5,000, as shown. In the central states, including the Pittsburgh district, the shortages increased from about 14,000 to about 20,000. The surpluses are small, everywhere, aggregating only about 4,000 in the whole country. The figures are net for each road and the statement gives no statistics of the number of cars owned by any road or the number on its line. Since the statement was made, that is to say, from November 1 to November 15, there has been a marked falling off in the demand of cars, principally on the grain-carrying roads in the middle west.

Proposed Standard Rail Sections of the American Railway Association.

The accompanying illustrations, which are all drawn to the same scale, accompanied the report of the American Railway Association's Committee on Standard Rail and Wheel Sections, dated Oct. 1, 1907. Further reference to these sections is made in the editorial columns.



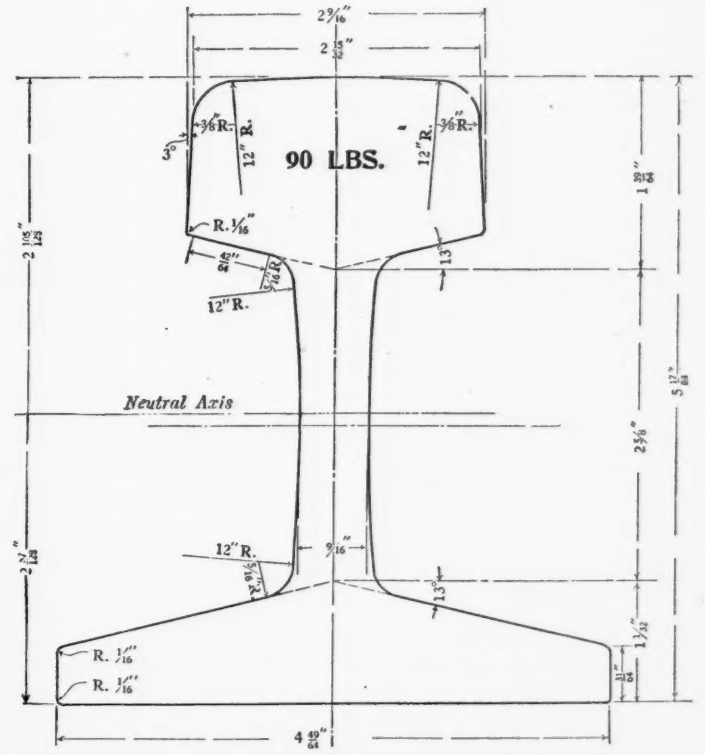
Area of Head	3.95	sq. in.	40.2%
" Web	1.89	"	19.2%
" Base	4.01	"	40.6%
Total	9.85	"	100.0%

Moment of Inertia 41.3"⁴

Section Modulus	Head	13.70"³
	Base	15.74"³
Ratio Periphery	Head to Area Head	1.64
"	Web " Web	3.60
"	Base " Base	2.49
Ratio Total	" to Total "	2.37

Calculated Weight 100.5 Lbs.

Series B.



Area of Head	3.56	sq. in.	40.1%
" Web	1.70	"	19.2%
" Base	3.61	"	40.7%
Total	8.87	"	100.0%

Moment of Inertia 32.3"⁴

Section Modulus - Head		11.45"³
"	Base	13.21"³
Ratio Periphery	Head to Area Head	1.68
" "	Web " Web	3.65
" "	Base " Base	2.58
Ratio Total	" to Total "	2.42

Calculated Weight 90.5 Lbs.

Series B.

Light Freight Handling by Electric Lines.*

BY P. P. CRAFTS.
General Manager, Iowa & Illinois Railway Co., Clinton, Ia.

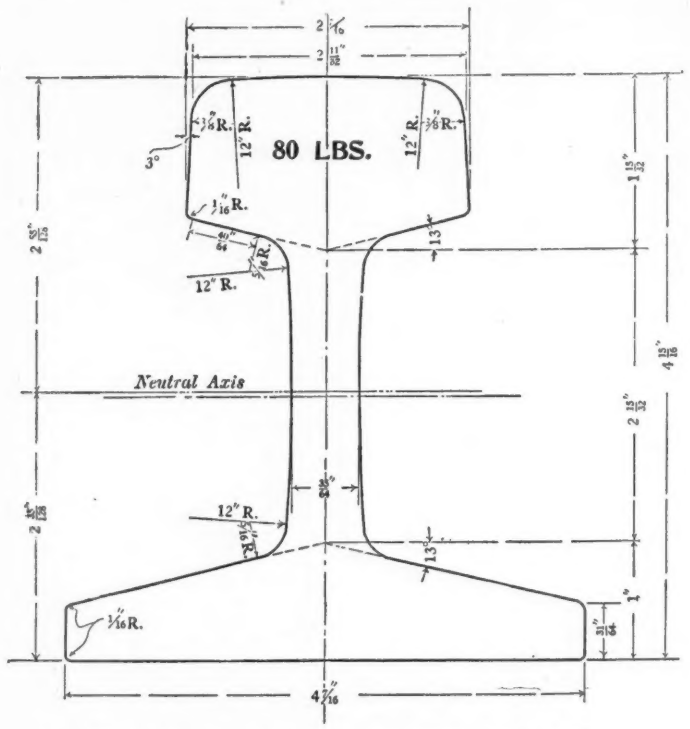
Although some of the older and slower roads began to conduct a so-called express business several years ago, the freight carrying field was not entered with spirit until the modern high-speed road, built on private right-of-way, with heavy construction, was developed. It was then discovered that the interurban could not only compete with the steam roads and express companies, but that, due to its frequent and reliable service, it could also develop a freight business that could not have been developed by them.

Whether or not a freight business will be profitable depends somewhat upon the following conditions:

1. The population served outside of the main terminal and its dependence upon that terminal as a trading center.

2. The proximity of other trading centers to the population served outside of the main terminal, and the railway facilities tending to attract business away from the main terminal.

*From a paper read before the American Street & Interurban Railway Association at its 1907 convention at Atlantic City.



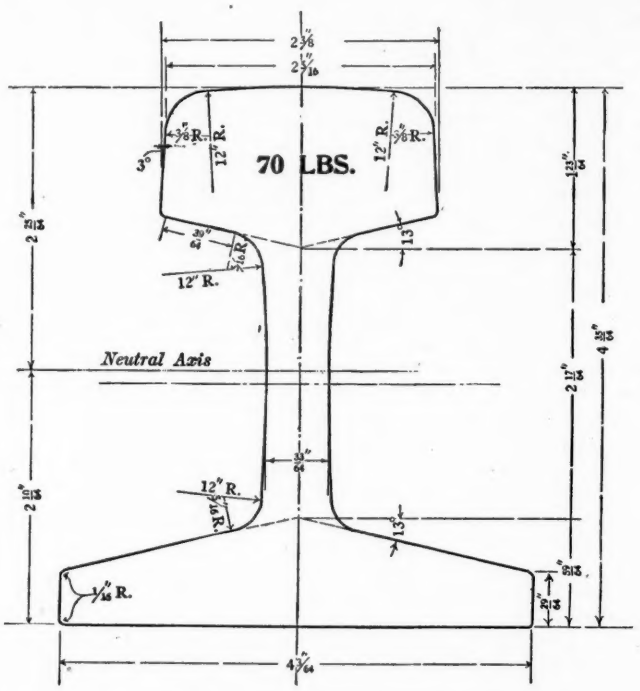
Area of Head	3.07 sq. in.		38.8%
" " Web	1.54	"	19.5%
" " Base	3.30	"	41.7%
Total	7.91	"	100.0%

Moment of Inertia 25.1"⁴

Section Modulus - Head		9.38"³
	Base	11.08"³
Ratio Periphery Head to Area Head		1.79
" Web	" Web	3.57
" Base	" Base	2.72
Ratio Total "	to Total "	2.53

Calculated Weight 80.7 Lbs.

Series B.



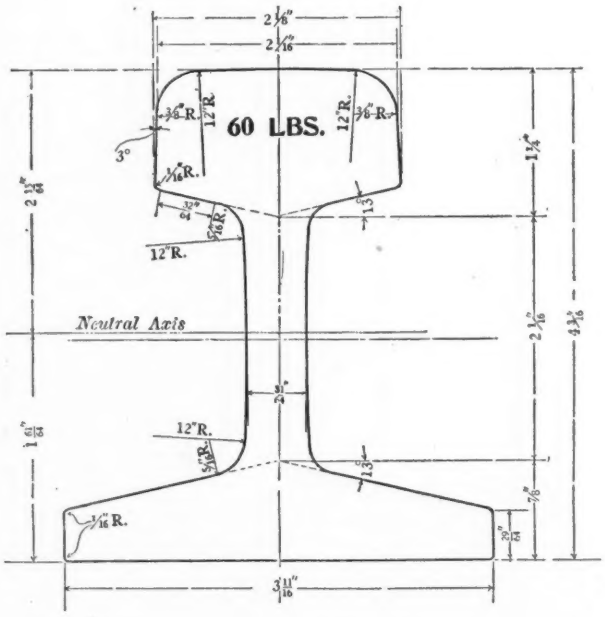
Area of Head	2.76 sq. in.		40.1%
" " Web	1.34	"	19.5%
" " Base	2.79	"	40.4%
Total	6.89	"	100.0%

Moment of Inertia 18.6"⁴

Section Modulus	Head	7.79"³
" "	Base	8.62"³
Ratio Periphery	Head to Area Head	1.99
"	Web " Web	4.10
"	Base " Base	2.76
Ratio Total "	to Total "	2.72

Calculated Weight 70.3 Lbs.

Series B.



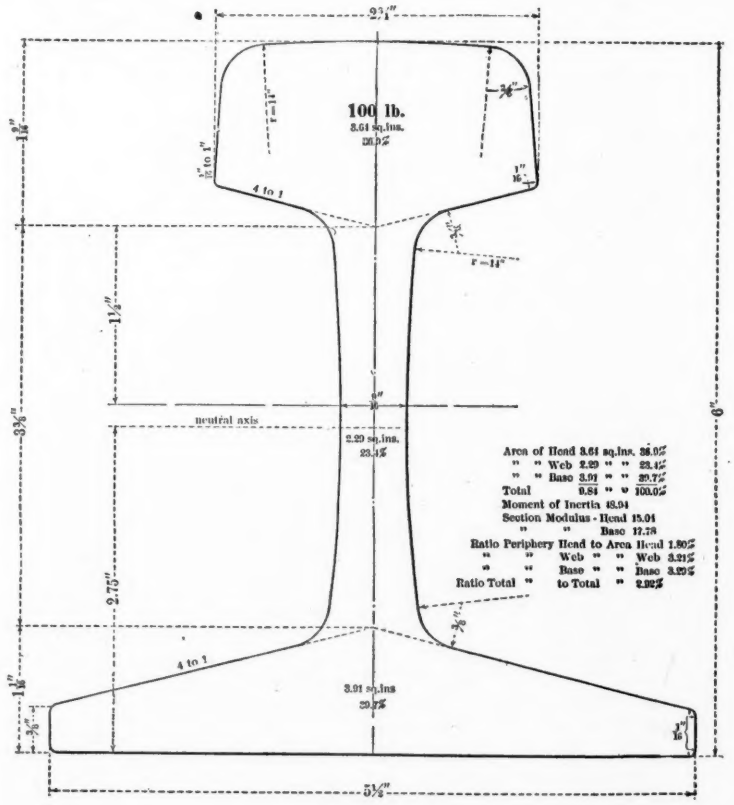
Area of Head	2.28 sq. in.		38.8%
" " Web	1.14	"	19.4%
" " Base	2.45	"	41.8%
Total	5.87	"	100.0%

Moment of Inertia 13.3"⁴

Section Modulus	Head	5.90"³
" "	Base	6.80"³
Ratio Periphery	Head to Area Head	2.10
" "	Web " Web	4.38
" "	Base " Base	2.94
Ratio Total "	to Total "	2.90

Calculated Weight 59.9 Lbs.

Series B.



Area of Head	3.61 sq.ins.		39.2%
" " Web	2.29	"	23.4%
" " Base	3.91	"	29.7%
Total	9.84	"	100.0%

Moment of Inertia 18.94
Section Modulus - Head 15.01
" " Base 17.78
Ratio Periphery Head to Area Head 1.80%
" " Web " " Web 3.21%
" " Base " " Base 2.29%
Ratio Total " to Total " 2.92%

Series A.

3. Steam trunk line connections leading to the main arteries of commerce and the ability of interurban roads to establish joint rates with them.

A full exposition of the third condition cannot be given without consuming too much time. In general, however, an interurban road with proper freight handling and terminal facilities, which offers quick and efficient service, together with joint rates with some trunk line, in competition with other trunk lines operating between competitive points, may reasonably expect a fair division, or a greater portion, of the freight traffic. As stated earlier in this paper, shippers desire the best service with lowest rates, but, assuming rates to be even, shippers are generally favorable to the roads which provide good passenger accommodations; consequently the interurban roads reap the reward of frequent passenger service.

Owing to the antagonistic attitude of the steam roads, however, it is generally difficult to establish joint rates except where competition does not exist between them, unless connection may be made with some competing road which disregards the pooling or territorial agreements.

Let us trust that the day is rapidly approaching when the national and state commissions will take such action as will induce our larger and more powerful brothers to recognize the despised interurban. The progressive and aggressive attitude of the interurban managers, if continued, will exert more influence in that direction than anything else that can be done.

Interurban freight traffic may be properly divided into the following classes:

1. Strictly light packages, transported only in baggage rooms of passenger coaches, at express rates or at a fixed charge per package or per hundred pounds, regardless of class, and generally termed express business.

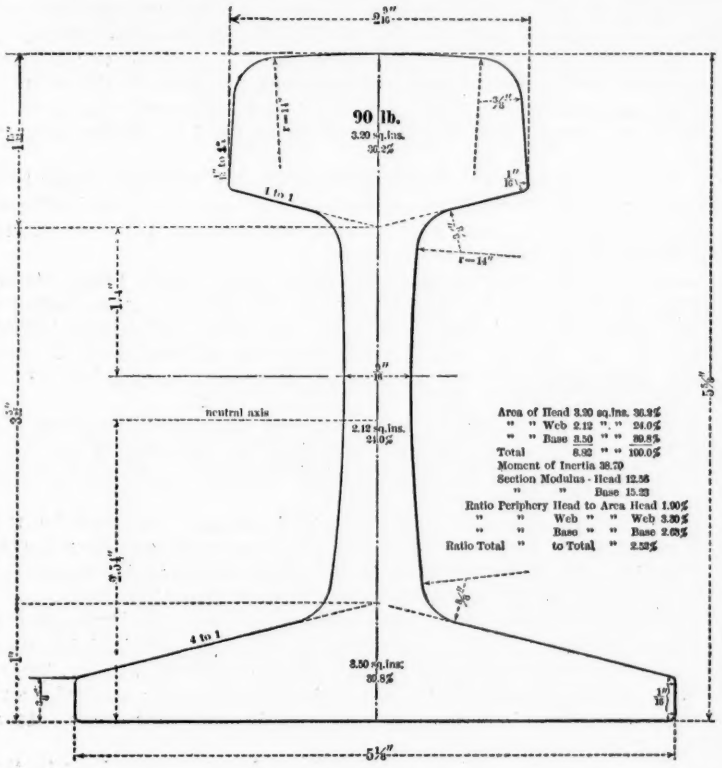
2. Less than carload freight transported on fast baggage cars at regular freight or special tariffs under regular or special classifications, generally the former.

3. A combination of class two and the haulage of a few carload shipments daily at regular tariffs and classification.

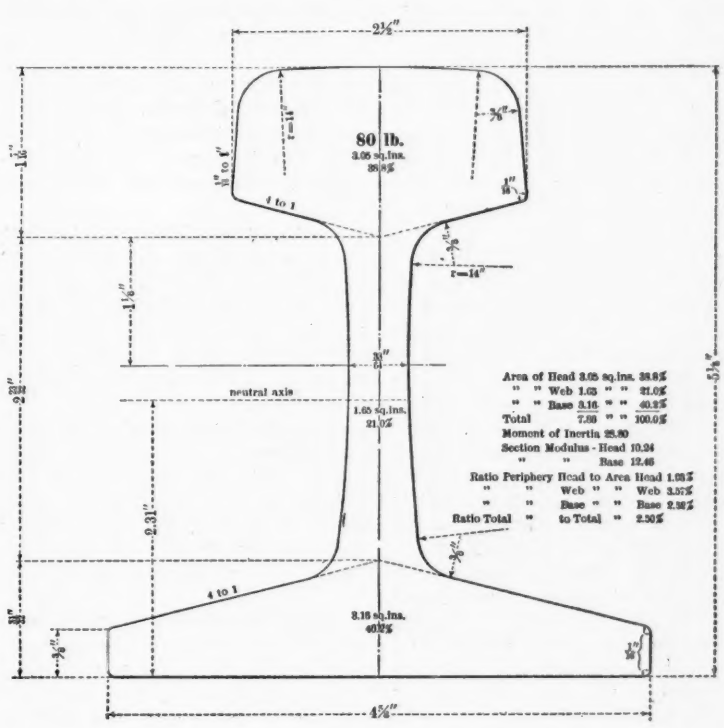
4. Regular carload tariff hauled by steam or heavy electric freight locomotives at regular tariffs and classifications. Or any combination of the above-mentioned classes.

Depending upon local conditions the freight traffic of a road may be confined to any one of these classes or it may be started in the first class and grow to the fourth class. As the fourth class will be discussed in another paper, I will treat only the first three ciasses, particularly the second class.

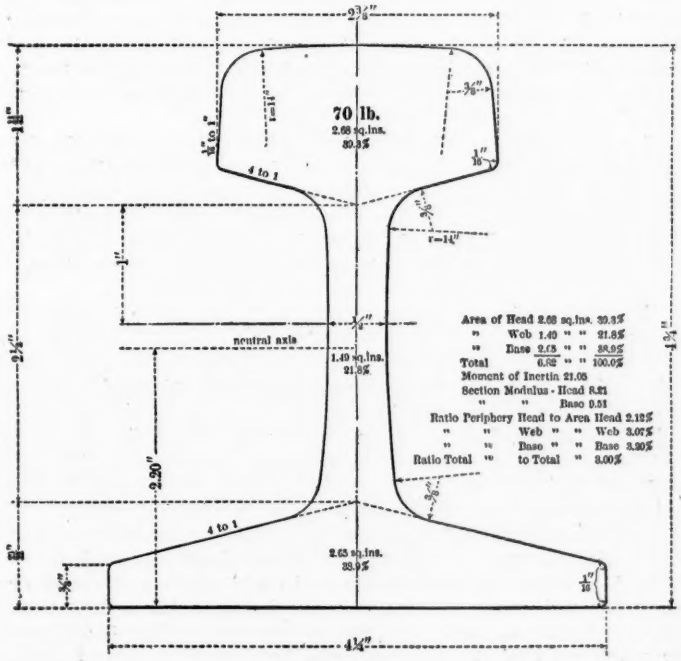
A freight business of class one may be conducted at small expense and is of material assistance in the earnings of a road.


90 lb.
3.90 sq.ins.
neutral axis
2.12 sq.ins.
3.50 sq.ins.
4 to 1
Area of Head 3.90 sq.ins. 30.9%
" " Web 2.12 " " 24.0%
" " Base 3.50 " " 39.8%
Total 8.92 " " 100.0%
Moment of Inertia 38.70
Section Modulus - Head 12.36
" " Base 15.22
Ratio Periphery Head to Area Head 1.90%
" " Web " " Web 3.30%
" " Base " " Base 2.63%
Ratio Total " to Total " 2.52%

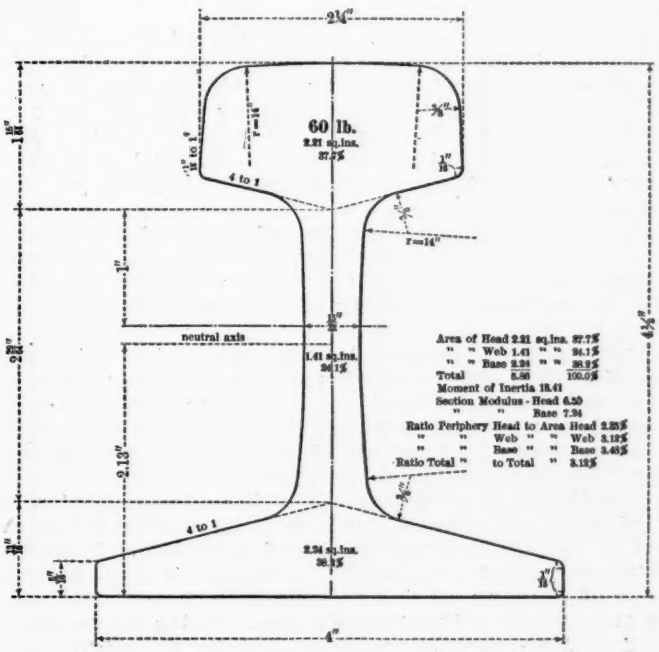
Series A.


80 lb.
3.05 sq.ins.
neutral axis
1.65 sq.ins.
3.16 sq.ins.
4 to 1
Area of Head 3.05 sq.ins. 38.8%
" " Web 1.63 " " 21.0%
" " Base 3.16 " " 40.2%
Total 7.86 " " 100.0%
Moment of Inertia 25.80
Section Modulus - Head 10.24
" " Base 12.46
Ratio Periphery Head to Area Head 1.02%
" " Web " " Web 3.57%
" " Base " " Base 2.32%
Ratio Total " to Total " 2.50%

Series A.


70 lb.
2.68 sq.ins.
neutral axis
1.49 sq.ins.
2.65 sq.ins.
4 to 1
Area of Head 2.68 sq.ins. 39.3%
" Web 1.49 " " 21.8%
" Base 2.65 " " 38.9%
Total 6.82 " " 100.0%
Moment of Inertia 21.05
Section Modulus - Head 8.21
" " Base 9.51
Ratio Periphery Head to Area Head 2.12%
" " Web " " Web 3.07%
" " Base " " Base 3.30%
Ratio Total " to Total " 3.00%

Series A.


60 lb.
2.21 sq.ins.
neutral axis
1.41 sq.ins.
2.24 sq.ins.
4 to 1
Area of Head 2.21 sq.ins. 37.7%
" " Web 1.41 " " 24.1%
" " Base 2.24 " " 38.2%
Total 5.86 100.0%
Moment of Inertia 13.41
Section Modulus - Head 6.50
" " Base 7.34
Ratio Periphery Head to Area Head 2.25%
" " Web " " Web 3.12%
" " Base " " Base 3.46%
Ratio Total " to Total " 3.12%

Series A.

The freight carried consists generally of packages easily transported in baggage compartments of passenger cars, which are usually empty except for a very few trips per day. Usually no extra office force is required, the only expense being for stationery, books, and possibly a small storage space at the main terminal. In some cases, when the charges are a certain rate per package, regardless of weight within reasonable limitations, a proper system of tickets dispenses with way-bills, expense bills, etc.

Inasmuch as the majority of freight-handling interurban roads comes under the head of class two, that part of the paper will probably be of interest to the greater number of managers, so I shall enter into greater detail in handling the subject.

Interurban roads which conduct their freight business under the head of class two more nearly approach operating conditions parallel to the time-freight business of steam railways. The ability of the interurban roads to make fast time and to deliver at highways, farm crossings and warehouse or store doors is an inducement to either the shipper or the receiver, which assists in obtaining the business. Being usually restricted, however, to a narrow car similar in appearance to a passenger car, due to operating over city streets, an interurban road has limitations of its freight earning capacity.

The profits of such a business depend largely upon the opportunity of the management to secure combined freight and passenger depots at the terminals and in the larger local towns, so that extra labor in billing and handling at stations may be avoided, upon the charges of terminal city railways for the right to haul freight over the tracks, and upon the hour of day when freight may be delivered to receivers.

Generally speaking, the margin of profit in this class is close and only careful management will produce a profit, particularly during the first few months after the business is started. Expenses must be carefully watched and attractive freight houses and convenient hauling facilities at terminals sacrificed for something which costs less to maintain.

Damage claims must be very carefully handled, and to that end it is advisable to adopt some system of billing and accounting which permits a shipment to be easily traced from its starting point to the final destination. Some interurban roads have adopted simple billing systems, requiring only one writing to make the receipt, way-bill, expense bill and office copy. Such a system, however, does not permit of proper checking, particularly if merchandise is transported over more than one road.

After an interurban road enters class two, a good local commercial agent is a necessity. The business, consisting of a great number of small shipments, requires constant development and care, particularly if competition exists. A live commercial agent, who is a good street man, and not a desk man, earns his salary many times over, particularly if he understands how to deal with shippers. The business obtained depends considerably on the personality of the commercial agent.

I fear that many managers, in charging expenses to the freight business, do not give proper consideration to such items as additional clerks, printing and stationery, insurance on goods in freight houses, a proper percentage of the receipts to cover loss and damage, power for freight cars, proportion of track and line maintenance, telephone service, interest on the freight handling investment, etc. Neglect of these items deceives the manager as well as his stockholders, and unless receipts grow beyond the safe point the awakening will be painful and embarrassing.

Perhaps a brief description of the freight business conducted by the Iowa & Illinois Railway Company may be of interest as illustrating the point brought out in the foregoing paragraph. We went into the freight business in a very tentative manner. In fact, it took considerable time for us to decide whether or not there was sufficient business in less than carload lots to warrant the purchase of a freight car and the expense of operating a freight business.

The next grave question was that of rates, and, after considering for some time a reduction of the rate below that permitted by the Iowa state laws for class "A" roads, we finally concluded to adopt the maximum tariff and to consider the business as freight and not express.

At first our old passenger depot in Davenport served also as a freight depot, but within a very few months we outgrew the capacity of the space allowed to freight and were forced to take our passenger business to a new location. In Clinton we still have sufficient space to handle the business, but within a very few months we will be compelled to seek additional storage room.

Immediately upon starting the business, we engaged a commercial agent, and the quick growth of the receipts to the point where we are paying expenses showed our wisdom in so doing. Within one year, with one freight car engaged in the business and the use of passenger coaches to carry some freight, the business grew to a gross exceeding $10,000 a year. During the summer and fall of 1906 we were compelled to operate our freight car two round trips per day for nearly 75 per cent. of the time, and after the contract with the American Express Company was put into effect, we purchased and placed in service a trailer freight car, having the same capacity as the motor. The improved facilities which we have been able to offer shippers since purchasing the second car have increased the business at a very rapid rate.

We make a specialty, on less than carload business, of beating the time of the steam railroads twenty-four hours between Davenport and points on the Chicago & North-Western Railway in the western part of the state. For this reason we obtain considerable business which is transferred to that road.

Besides the rush shipments in small quantities of perishable goods, such as milk, cream, butter, eggs, fruit, etc., from certain stations are handled in the baggage rooms of the passenger coaches.

We find that a trailer freight car is much cheaper to operate than a motor, but, of course, it can handle only through business. It does not seriously delay the passenger coach to which it is coupled.

When the freight business was started, we adopted what we considered to be a very simple set of forms for billing and accounting, but we soon ascertained that the tracing of damaged and stray shipments was very difficult, and after carefully looking over the field we finally adopted the forms used by the Chicago & North-Western Railway. These appeared at first to be very complicated, but a short acquaintance indicated their simplicity and the ease of tracing damaged and stray shipments.

We make a specialty of rush orders by telephone via our private line. Often a merchant in Clinton who finds himself short of some particular article telephones to us, and through our Davenport office via the private line, we transmit the order to the shipper in Davenport. Shipments so ordered are frequently in Clinton within two hours from the time we were called up at the Clinton office.

At the present time the earnings from this business amount to 15 per cent. of the total gross, and we hope to see it reach 20 per cent. on the same basis, i. e., while our freight business comes under the head of class two.

Our transfer business has been developed under heavy steam road competition at lower rates, for in obeying the state laws we have been compelled to charge two local rates which are higher than the rate for the same mileage in a continuous haul on one road. The saving of time mentioned above has accomplished that result.

A recent ruling by the Iowa Railway Commission reduces the tariff on two locals 20 per cent., and although our receipts per shipment will be naturally reduced, the increase in volume of business will be gratifying.

This exposition of the freight business as conducted by the Iowa & Illinois Railway is not made so much to indicate what is being done by that road, but is rather intended to illustrate the methods generally pursued by interurbans of like character.

An investigation made of a number of roads has brought out the fact that the average interurban conducting a freight business pursues practically the same methods described in this paper. There are of course a number of roads which pursue other methods, and successfully, too, but in such cases local conditions govern to a great extent.

The percentage which earnings from freight traffic bear to the total gross earnings, of course, depends largely on local conditions, but of those roads which have favored me with statistics, I have ascertained that these earnings vary from 5 to approximately 40 per cent. of the total gross. Interurbans which handle carload business, in addition to the traffic of which this paper treats, in some cases enjoy gross earnings from freight exceeding those derived from passenger traffic.

I believe the experience of interurban railways to this date is that such satisfactory results are now being obtained, I am safe in predicting that any average interurban railway, the existence of which is warranted by prospective passenger traffic, can be assured of a profitable freight business, which within a few years, if not immediately, will become an important factor in its earnings.

The French have for some time had in operation in their northernmost Asiatic possession, Tongking, a railroad from the sea at Haifong northwesterly up a river for about 200 miles to the Chinese border at Laokay. Hoping to draw traffic from China over this railroad and to ports in Tongking, a company was organized to build from Laokay in China further northwest through a mountainous country, a further 200 miles to Yunnan-sen. The colony advanced 12½ millions of francs, bonds were issued for 76 millions, and the stockholders of the company subscribed 7½ millions. This has all been spent and the road is far from completion. From 50 to 60 millions more are required, 35 millions of which is needed in 1907. There is a controversy as to whether the company or the colony should make up the deficit; but pending arbitration the money will be advanced by the government. This indicates that the whole cost of the railroad will be something like $29,000,000, or about $145,000 per mile.

GENERAL NEWS SECTION

NOTES.

The Erie Canal will be closed December 10.

On November 4, the Pennsylvania Railroad had 52,622 stockholders, as against 49,572 on October 1. This is an increase in 25 days of 3,050, or a little more than 6 per cent.

The individual car owners have again failed to perfect their proposed organization, a meeting called to be held at Cleveland having been so poorly attended that no action was taken.

The superintendent of railway mail service at Houston, Texas, has called upon the railroads to remove from the windows of mail cars all iron bars which would prevent a man from getting out of the car through the window in case of accident.

The State Railroad Commission of Louisiana has amended its rule concerning reports of accidents, and hereafter will not require telegraphic reports except of accidents where persons are killed or seriously injured by the operation or wreck of a train.

At San Bernardino, Cal., W. A. Basore & Sons have moved an oil tank belonging to the Atchison, Topeka & Santa Fe, weighing 300 tons. The tank, used for locomotive fuel oil, is 96 ft. in diameter and 80 ft. high. It was moved from the old to the new yards of the road.

At Easton, Pa., last week $5 checks which had been issued by the Central Railroad of New Jersey, in consequence of the scarcity of currency, were counterfeited, and it was said that forged checks aggregating $8,000 face value had been presented at the railroad company's offices.

The Union Pacific has run a train wire into a business college in Omaha, in pursuance of an arrangement to have the college teach telegraphers for the service of the railroad. The Atchison, Topeka & Santa Fe is to open a school for apprentices at the company's shops in San Bernardino, Cal.

United States steamer "Marine" reached Rock Island, Ill., November 15, from Hennepin, Ill., completing the first trip through the recently opened Illinois and Michigan canal. The steamer was met by a delegation of citizens and by the blowing of whistles. The canal is 60 miles long, connecting the Illinois and Mississippi rivers.

In the United States Circuit Court at Boston, November 17, Hollis R. Bailey was appointed receiver for the Enterprise Transportation Company of Worcester. The company has been in operation for about two years as a competitor of the Fall River Line, running steamers between Providence, Fall River, Newport and New York.

The new Constitution of the state of Oklahoma went in effect November 16 and the railroads of the state (which include the former Indian Territory) are carrying passengers at 2 cents a mile. The Rock Island announces that it will ask the State Corporation Commission to exercise its authority to exempt the road from the law.

The New York City Railway Company, operating the surface street car lines in Manhattan, in the year 1904 discharged 3,491 conductors, of whom 3,017 were dismissed for dishonesty. In 1905 2,448 were dismissed for that reason, in 1906 3,924 and in the first six months of 1907 2,792. Officers of the company believe that dishonest conductors pocket about $35 a week each.

A press despatch from Montgomery this week says that the Seaboard Air Line has agreed with the Governor of Alabama to withdraw its suits against the state, brought to contest the legality of the reduced passenger fares ordered by the legislature, and that on December 1 it will reduce fares to 2¾ cents a mile. On freight the Seaboard Air Line will make rates on the same basis as those charged by the road in Georgia.

In the United States Circuit Court at Buffalo, November 18, on application of the Delaware, Lackawanna & Western, a temporary injunction was granted restraining the Switchmen's Union from breaking its agreement with the railroad company. The union threatens to strike if the road does not grant a large increase of wages, though its members are working under an agreement which does not expire before January 31.

The Interstate Commerce Commission has issued general authority to make rail and water freight tariffs with a provision that they will be suspended, at the close of navigation, on seven days' notice. The resumption of such tariffs in the spring must be preceded by ten days' notice. If a shipment forwarded on a rail and water rate has to be sent through all the way by rail, the line (or combination of lines) which accept it at the low rate must pay the difference between that and the all-rail rate. On the opening of navigation shipments may be received under the rail and water rate for concentration at the ports on the date that the rates take effect.

The Attorney-General of Nebraska has entered suit against the Union Pacific, alleging discrimination against E. W. Jacobs, who was "disciplined" by the road for driving his cattle into Nebraska to take advantage of reduced rates. Jacobs ordered cars at Big Springs, and after he reached that place with his cattle was compelled to pasture them about in the hills for twenty-five days before he could get cars. In the meantime shippers on either side of Big Springs were furnished with cars.

With a view to complying with the Federal 16-hour law, the New York Central has made experimental changes in the runs of certain freight trainmen. Men running through from Albany to Syracuse, 148 miles, are to be taken off at Utica, 95 miles, though the trains and engines will be run through precisely as before, not going into the yard at Utica. On some of the trains the crews have for some time past changed at Little Falls, half-way between Albany and Syracuse. This practice will be continued.

The Post Office Department has ordered that until December 25 equipment, supplies and empty mail bags, which for the past six months have been sent mostly by freight, shall be sent in the mail cars. The order appears to be based on the fear that in the holiday season there will be intolerable delays in freight transportation. Some of the Chicago roads are complaining at this action of the department, declaring that the additional matter will have to be carried without remuneration. This year's appropriation for the Post Office Department includes $250,000 for the outside transportation of the articles above named.

At Chicago, last week, before the Illinois Railroad and Warehouse Commission, W. A. Gardner, Vice-President of the Chicago & Northwestern, declared that the present charges for switching in Chicago are less than the actual cost of the service. The hearing was on a complaint brought by the Illinois Manufacturers' Association and the Chicago Association of Commerce that switching charges are excessive. "Switching rates are lower than they were fifteen years ago, taking into consideration the fact that the capacity of cars has doubled since that time," said Mr. Gardner. "Yet, during these years the cost and the intricacy of the work has greatly increased. The payrolls for switching are 33 per cent. greater than a year ago, but the increase in the number of cars handled has been only 10 per cent." Mr. Gardner advocated a rate per ton and a classification of freight to apply to switching movement.

The Pennsylvania Railroad announces that shop men working on repairs will henceforth work eight hours a day. Reductions will be made in the track forces and in other departments where the business of the road will not suffer. Superintendents have been ordered to suspend men wherever it can be done without crippling the forces. Similar reports of retrenchment are published concerning many railroads, but few of these reports are given with definiteness. At Chicago, Slason Thompson, representative of the General Managers' Association, estimates that 25,000 men have been dismissed by Western railroads. A considerable part of these men were engaged on new construction, but no information is given to show how many. The Chicago, Milwaukee & St. Paul has dismissed 50 freight solicitors, mostly in cities off the line of the road. The Northern Pacific has taken similar action in the Eastern states. The Erie has dispensed with the services of a number of traveling passenger agents.

Mr. Hill on the Financial Crisis.

The following extracts are taken from an address made by James J. Hill at Kansas City, November 19:

"Perhaps the controlling factor of the situation in this country is the shock given to confidence in our investments all over the world and the consequent limitation of credit. Credit is the atmosphere which inflates the lungs of business, and when it is greatly lessened business must be reduced in proportion or be quietly smothered. For this reason attacks, not on individual transgression, not on dishonest finance, but upon existing business systems representing the fabric of society itself, may destroy by impairing credit what a generation could not rebuild. Political campaigns in many states have been made on the issue of a general assault on the integrity of railroad property and management. There followed a wild raid in which over 170 acts more or less confiscatory of railroad property were enacted by the legislatures of more than a score of states. The consequences to the transportation system, to railroad construction, and through these to the price of farm products and to the success of every form of business have already made themselves felt and the country shivers under the blow. If such continue to be the atti-

tude of the public mind there will presently be no power, short of a pledge of the credit of the Government itself, able to secure the funds necessary to provide more tracks.

"Before we again realize a favoring disposition to invest, there must be a different temper, a larger view of justice, a better appreciation of what the railroads of the United States have done and are doing as compared with those of the rest of the world, and a settled policy of fair and reasonable liberal treatment, and protection for the future. The duty of the state toward the railroad property, which should have the rights common to other property, must be considered, as well as the duty of the railroad to the public.

"It is necessary to this end that the operations of our railroads should be regulated properly by wholesome and fair laws, and quite as necessary that they should not be regulated improperly. Regulative statutes are now in force of such scope and stringency that no one denies their efficacy.

"It would be easy so to multiply and add to their burdens that the confidence necessary to investment would be entirely destroyed and the development of the country prevented.

"Whether this is a time for new enactments or for a patient, fair and just enforcement of the laws as they stand may be judged from the records of the past.

"We have read of a conflict between righteousness and business. There can be no such conflict unless there is fraud at the business end or hypocrisy and cant at the righteousness end. If any man has done evil, if any corporation is sinning against the laws, let him or it be punished under the law. But put an end to wholesale denunciation and wholesale proscription, destructive of all credit and repugnant to all sense of justice, as well as hostile to every business interest in the land.

"There are but two reasons, actual scarcity of money and reluctance to invest, which overshadow the outlook. Promising enterprises can no longer be financed on any basis consistent with present rates and conditions.

"The transportation facilities of the whole country are and have been unequal to its present means. They must be made equal to the burdens they bear or the country cannot prosper. The railroad men of this country have a right to be proud of their record, and resent criticism supported by nothing better than ignorant declamation."

Profit Sharing by Stock Ownership.

Employees of the United States Steel Corporation will probably this year get their preferred stock under the profit sharing plan very much cheaper than a year ago, when $102 was agreed on. Since the profit sharing plan became operative in 1903, the corporation has sold to employees 150,496 shares, the present market value of which, at $81 a share, is $12,190,176. The amount paid for the stock was $12,558,445, so that apparently the employees have lost on paper a little over $350,000; but rebates and dividends received by employees offset this loss many times over. On Dec. 31, 1906, there were 15,568 employees who had purchased stock under offers made by the corporation. This indicates that considerable stock has been liquidated.

The Pullman Company.

Gross earnings for the year ended July 31, 1907, were $32,186,013, an increase of $2,597,371. Operating expenses were $17,388,741, an increase of $2,044,000. Dividends amounted to $7,476,878, an increase of $1,556,894. These dividends do not include the distribution of accumulated surplus made in November, 1906. The surplus for the year was $4,149,455, a decrease of $820,619. The mileage of road over which the company operated cars was 195,250, an increase of 4,817. The number of passengers carried increased 11 per cent. and the number of miles run increased 7 per cent. The company built $37,019,627 worth of cars, an increase of $9,300,635. At the annual meeting, George F. Baker, New York, was elected a Director, succeeding Charles S. Sweet, Chicago.

Irrigation in Southern Pacific Territory.

Nearly a million acres of land is being reclaimed by irrigation along the lines of the Southern Pacific. In the neighborhood of Yuma, on the Colorado river, 100,000 acres partly in Arizona and partly in California, will be served by the canals now building, on which rapid progress is being made. Profitable cultivation of this soil has heretofore been impossible owing to the destructive floods of the Gila river. Now this section is being made ready for the settler by a dam across the Colorado above Yuma, by canals under the Gila and a system of levees which will protect the territory from overflow. The lands saved from destruction by the Southern Pacific's success in closing the breach in the Colorado are yielding phenomenal crops. Yuma has about 2,000 population. With Phoenix as a center, another vast irrigation work, covering 200,000 acres, is being carried out. Here, as around Yuma, the climate is favorable to oranges, and other fruits of many kinds, all served by the lines of the Atchison, Topeka & Santa Fe from the north and the Southern Pacific on the south.

On the Truckee-Carson project in Nevada, the government is spending $9,000,000 in reclaiming 350,000 acres. From the Southern Pacific a branch line has been built diagonally across the newly irrigated area. Further north, on the border line between California and Oregon, is the Klamath project. Through this territory the Southern Pacific is building a line which will eventually run from Weed, Cal., to Natron, Ore., and become the main line of the road in place of the present Shasta route. Nearly 250,000 acres of a fertile soil will be affected by the irrigation work now well under way here.

Railroad Strike in India.

Traffic on the East Indian Railway, 2,165 miles long and the second largest railroad in India, is rapidly becoming paralyzed by a strike, according to a Calcutta despatch dated November 20. The trouble began with the European engineers. The most important section of the road from Calcutta to Allahabad, is tied up and several thousand passengers are stranded at the junction of the road with the Bengal-Nagpur Railroad. Many engineers in their engines have left their trains at remote stations. This is an especially serious time for a strike because famine is spreading and there is need for speedy transportation of relief supplies.

American Blower Company's Exhibit at Atlantic City.

A view of the exhibit of the American Blower Co., Detroit, Mich., at the recent convention at Atlantic City of the American Street and Interurban Railway Association is shown herewith. It will be observed that it includes the same interesting feature that attracted so much attention at the railroad mechanical conventions in June—that of a light sphere suspended in the blast from a high-pressure blower. It is reported that members of this convention were no better able to offer a satisfactory solution of the phenomenon than were those of the previous convention.

American Blower Company's Exhibit.

Inquiry on British Rates.

Now that the long strike agitation in England is satisfactorily settled, the President of the Board of Trade intends to devote his attention to another railroad matter of almost equal importance to British railroads, and that is the question of rates. It is his intention at an early date to appoint a commission, or rather committee, in which will be included several practical railroad men to consider, among other things, the whole question of railroad rates and the desirability of revision on a larger scale than could conveniently be carried out by the Railway and Canal Commission. At the same time the possibility of lowering working expenses by reducing competition and in other directions will probably be discussed. It is expected that the chairman of one of the southern lines will be asked to assist the committee with his long experience in all departments of railroad work, and a leading general manager will probably be added. Mr. Lloyd-George has been much impressed with the great waste which necessarily results from such cases as the working of three competitive routes to Scotland or four routes to Manchester. British railroad managers will be the first to welcome any means of reducing this expenditure, which does not lay them open to the charge of pooling.

Taxation Without a Hearing.

The decision of the Georgia Supreme Court, holding valid an assessment of back taxes for ten years on 30,000 shares of the Western Railroad of Alabama, a foreign corporation, has been reversed by the Supreme Court of the United States. The decision will upset the laws of many states on the taxation of property upon which the owners fail to make returns. The Western Alabama shares were held by the Central of Georgia and the Georgia Railroad & Banking Company, as trustees. They refused to make returns on the ground that the shares of a foreign corporation were not subject to taxation; but taxes were assessed and the companies sought to restrain their collection by claiming discrimination in that the shares of domestic corporations were not taxed, that under the Georgia law a hearing was denied them and that the property itself was taxed in another state. The only question considered in the appeal to the Supreme Court of the United States was whether the Georgia law providing for assessment of taxes on omitted property without hearing was due process of law. The court held that it was not and that it fell within the intention of the Fourteenth Amendment to protect property from such impairment by state action.

Indian Railroad Organization.

In consequence of representations made by the Indian Railroad Board, the Government of India has decided on some modifications of the control which it has previously exercised over the capital expenditure of Indian railroads through the consulting engineers. This control, indeed, has been of a minute character, and extends not only to matters of engineering and of expenditure, but to practically all questions, both executive and administrative, connected with railroad working. The Government now admits the force of the board's argument that the altered conditions and revised contracts under which the companies now construct and work the railroads give scope for more liberal and elastic methods. The following changes in organization are, therefore, says a correspondent of *The Times* (London), to be brought into force from January 1 next. Certain powers of sanction and administration are to be delegated to the companies' boards, which are to be requested to entrust their chief representatives in India with a considerable portion of their own powers, Government reserving the right to re-impose more detailed powers of control should circumstances require it. The appointment and duties of provincial consulting engineers are to be abolished, except that their work as inspectors will be carried out by officers specially charged with that duty.

INTERSTATE COMMERCE COMMISSION RULINGS.

Rates on Butter and Eggs Reduced.

In an opinion by Commissioner Lane decision has been announced in the case of the Morse Produce Co. v. Chicago, Milwaukee & St. Paul et al. It appeared that the rate on butter and eggs from Granite Falls, Minn., to Chicago, Ill., is 56 cents per 100 lbs. in car load lots, while from Pipestone, Minn., to Chicago the rate is 43 cents, although Granite Falls is 41 miles nearer Chicago. The Commission held under the facts and circumstances of this case that the 56-cent rate of the Chicago, Milwaukee & St. Paul is unreasonable and unjust and should not exceed 43 cents per 100 lbs.

Violations of Rate Law Must be Substantial, Not Technical.

The Commission, in an opinion rendered by Commissioner Harlan, has announced decision in the case of Missouri and Kansas Shippers' Association v. Missouri, Kansas & Texas. This was a proceeding based on an infraction of the long and short haul section and involved reparation for shipments of hay from certain points in Kansas to Kansas City and St. Joseph, Mo. The Commission held that a merely theoretical or paper rate that has not been used and was unknown to the defendant until casually discovered will not be accepted as affording a just basis for an order for reparation on shipments made to an intermediate point at a slightly higher rate. The Commission is essentially an administrative body, and in the examination of formal complaints ought to get at the real substance of the issue presented unembarrassed by technical considerations.

Joint Rates Need Not be Made.

The Interstate Commerce Commission, reporting on the application of the Loup Creek Colliery Company, of Page, W. Va., refuses to order the establishment of a through joint rate where the railroads have not made one. The complainant is on the Virginian Railway, nine miles from its junction with the Chesapeake & Ohio, and desires to ship coal and coke over the Chesapeake & Ohio at the same rates which are paid for shipment from points in the same vicinity, which are situated on the C. & O. The freight is carried satisfactorily now, but the roads refuse to make through rates. The Commission finds that the prices paid are reasonable, and that the rates from C. & O. points are also reasonable; that to make the desired order would compel the C. & O. to discriminate between its own shippers or else make an unnecessary reduction in some of the rates. The decision is by Commissioner Clements.

Coal Rate Upheld.

In the case of The A. M. Fellows Coal & Material Co. v. the Missouri Pacific, opinion by Commissioner Clark, the complaint was dismissed. It was alleged in this case that the rate on coal from a mine at Jewett, Kan., to Kansas City, Mo., is unjust and unreasonable. The record showed that the rate is the same as from other mines in the same field—the same as that on a competing railroad in the same field—and that it is fixed in accordance with an established relation of rates on coal from other producing points to the same market. It also appeared that the rate complained of could not be changed without disturbing rates on coal, not only from other neighboring mines, but from all coal-producing centers the product of which is sent to Kansas City. The Commission decided that under the circumstances and conditions disclosed by the record there is no justification for ordering the rate changed or declaring it unreasonable.

Express Rates Ordered Reduced.

In the case of McLaughlin Bros. v. Adams Express Co. (opinion by Commissioner Lane) it was shown that the Adams Express Co. charged a rate per car for the transportation of horses from New York to Columbus, Ohio, of $200; from Columbus to Kansas City, Mo., $350; from Columbus to St. Paul, Minn., $350. The rate per car from New York to St. Louis is $300; from St. Louis to Kansas City, $150; from New York to Chicago, $250; from Chicago to St. Paul, $200. Thus the total charge from New York to Kansas City when the shipment is stopped at St. Louis is $450; when stopped at Columbus, the total charge is $550. Similarly, the charge from New York to St. Paul is $450 when the shipment is stopped at Chicago, and $550 when the shipment is stopped at Columbus. The Commission decided from all the facts presented that the rates west of Columbus are unreasonable and excessive, and ordered that the rate from Columbus to Kansas City and from Columbus to St. Paul shall not exceed $250 per car.

Switching Charges May Legally Fluctuate.

The Commission, in an opinion rendered by Commissioner Clark, has announced its decision on six separate complaints against the Chicago, Milwaukee & St. Paul by J. H. Leonard and others. Coal carried by this road to Kansas City was delivered on the lines of other carriers which assess a switching charge of $3 a car. At one time the defendant absorbed the switching charge, later discontinued the practice and subsequently resumed it. The complainants allege that as the defendant indulged in the practice and after discontinuance resumed it that it has committed itself to the unreasonableness of requiring shippers to at any time pay switching charge and therefore reparation was asked for. The Commission decided that to support the contention of complainants would be to say that transportation charges must in every instance remain at a fixed figure or be reduced by the carrier at the peril of being called upon to respond in damages on all charges that have before that time been collected under the rates so reduced. It was admitted that there was no discrimination between shippers and the Commission ordered the complaints dismissed.

Switching Charges Upheld.

The Commission, in an opinion by Commissioner Clark, has announced decision in two cases brought by the Laning-Harris Coal & Grain Co. against the Atchison, Topeka & Santa Fe. It appeared in these cases that after arrival, and usually after sale, of grain transported in carloads by defendant to Kansas City, the owners direct the delivery to points on the lines of other carriers which assess a switching charge which defendant collects for and pays to said other carriers. The complaints in these cases alleged that defendant's published rate on grain to Kansas City includes delivery at any point in Kansas City desired by the shipper, whether on the line of defendant or on the lines of any other carrier, and that the switching charge is therefore unlawful and unreasonable.

The Commission decided that the law in specific terms provides that a common carrier shall not be required to give the use of its tracks or terminal facilities to another carrier engaged in like business. In the absence of tariff provisions to the contrary, the transportation rate shown in a carrier's tariff on a certain commodity to a given point is understood to include delivery only to industries or unloading points located on its own rails. If a consignee

or owner of the shipment desires delivery to a point located on the line of another carrier, it must pay the lawful charge for such service. The complaints in these cases are of no merit and should be dismissed.

TRADE CATALOGUES.

Storage Batteries.—The Gould Storage Battery Company, New York, has published a pamphlet which describes and illustrates the construction of the company's storage battery. Both positive and negative plates are of the Planté type; that is, pure lead plates whose active material consists of thin layers of lead peroxide on the positive plates and spongy lead on the negative, these layers being renewed by chemical action from the pure lead. The pamphlet goes into the advantages of the design of construction, describes the preparation of the material and concludes with a resumè of the general advantages claimed for the battery. It is illustrated with half-tones of separate plates, of different types of batteries and of complete installations.

Valves.—The October issue of *The Valve World*, published in the interests of the Crane Company, Chicago, contains articles on pipe threading and cutting machines, improvements to back pressure valves for non-condensing engines and a large installation of piping for the Calumet & Hecla Mining Company. Among other articles there is an interesting one on the methods employed by the Crane Company for taking care of the health of their employees.

Storage Batteries.—The General Storage Battery Co., New York, has issued a pamphlet describing an installation of Bijur storage batteries at the Johnstown, Pa., works of the Cambria Steel Company. A striking feature is the reproduction of recording ampere meter charts indicating the comparative fluctuations of current at the power house before and after the battery was used, showing the effect which the installation had on handling of high intermittent loads.

Steam Shovel News.—The October number appears with a new cover design which greatly improves the appearance of the magazine. "Steam Shovels on Light Railroad Construction" is the leading article, and is well illustrated with good half-tones from photographs. A special high-crane shovel for a clay pit is described and illustrated at work; there are a number of shorter articles and notes of interest.

Poles.—The John Simmons Company, New York, has published a folder describing the construction of tubular steel poles and the advantages of them as compared with wooden poles. The folder is illustrated with photographs of the 92-ft. steel pole made and erected by the company on top of the Singer building in New York, and by drawings of other types of flag poles and fittings.

Coal and Ash Handling Machinery.—Catalogue D of The Jeffrey Manufacturing Co., Columbus, Ohio, illustrates a large number of coal and ash handling machinery installations at different plants throughout the country. There are 56 pages of line and half-tone engravings which show the general features of the different installations.

The Otto Gas Engine Works, Chicago, is distributing a map of the Panama canal, including a profile of the canal and a cross-section of the Culebra cut. A printed note gives briefly the final plans of the canal. Above the canal map is one showing shipping routes of the three Americas.

Air-Brakes.—Two recent bulletins of the Allis-Chalmers Company, Milwaukee, Wis., deal with air-brake equipment for electric cars. One of the bulletins is devoted to type O-B pneumatic emergency equipment and the other to the type J emergency valve for straight air-brake.

MANUFACTURING AND BUSINESS.

The New York offices of the Raymond Concrete Pile Co., Chicago and New York, have been moved to 140 Cedar street, the new West street building.

The Canadian Steel & Wire Co., Hamilton, Ont., has received the contract for fencing the Grand Trunk Pacific between Edmonton, Alb., and Winnipeg, Man., about 1,000 miles.

George A. Gallinger, heretofore connected with the Chicago office of the Independent Pneumatic Tool Co., Chicago, has been appointed manager of the Pittsburgh, Pa., office at 1210 Farmers Bank building.

W. Martin Johnson has been elected Second Vice-President of the Schoen Steel Wheel Co., Pittsburgh, Pa., in charge of the sales department. Mr. Johnson's headquarters will be in the New York office of the company, 11 Broadway.

J. G. White & Co., New York, recently shipped to Manila, P. I., on the steamship "Croydon" $250,000 worth of locomotives, cars and construction material for the Philippine Railways Company.

The Allis-Chalmers Company, Milwaukee, Wis., has been awarded a gold medal for electric generators and motors exhibited at the Jamestown Exposition. A second gold medal was granted for the design and erection of the exhibit.

The Central Inspection Bureau, New York City, has an order from the Northern Electric Street Railway, Scranton, Pa., for the inspection of a number of passenger and baggage cars to be built by the J. G. Brill Company, Philadelphia, Pa.

The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., is furnishing the reinforcement for the construction of three circular reservoirs, 100 meters in diameter, for the Potable Water Commission, City of Mexico. The order is for 2,600 tons of corrugated bars.

The United States Engineering Office, through S. W. Roessler, Portland, Ore., has been in the market for four hoisting engines, in addition to the three locomotives reported in the *Railroad Gazette* of November 8. Proposals for locomotives and hoisting engines were opened November 18.

Harry A. Houston, Springfield, Mo., won this year the Joseph T. Ryerson scholarship of the American Railway Master Mechanic's Association at Purdue University. This scholarship is awarded after competitive examination. Mr. Houston, who is 20 years old, entered Purdue at the opening of the fall term and will take the course in mechanical engineering.

Net income of the Union Switch & Signal Co., Swissvale, Pa., for the year ending December 31, 1907, is estimated at $1,100,000. The company has about $1,250,000 of accounts receivable and enough money in bank to meet the payroll for two months. For the nine months ended September 30, net income, after charges amounting to $2,930,000, was $853,000, an increase of $125,000.

Civil service examinations will be held on December 11 and 12 of candidates for the following vacancies: topographic draftsmen on Panama Canal, salary $125 to $175 a month; assistant superintendents of construction, quartermasters' department, at Cheyenne, Wyo., $1,200 a year, and at Fort Sam Houston, Tex., $900 a year; engineer draftsman, office of the supervising architect, treasury department, $1,600 to $1,800 a year.

The contract for the three large skylights for the new national museum, at Washington, D. C., has been awarded to Arthur E. Rendle, of New York, Chicago and Montreal, to be glazed on his Paradigm skylight system. Eleven firms bid on the work and Mr. Rendle's bid was the lowest. The glass roof and skylights (80,000 square feet) on the new union station buildings at Washington were also glazed by the same contractor.

A test was made recently by the engineers of the New York Edison Co. at the Waterside station, near Thirtieth street, New York City, of a Westinghouse turbine of 10,000 h.p. capacity. It had been sold under a steam consumption guarantee of 15.9 lbs. of steam per kilowatt hour, but the test recorded less than 14.9 lbs. per kilowatt hour. This result gained a bonus for the Westinghouse turbine of over $25,000. This steam consumption figures less than 1½ lbs. of coal per kilowatt hour.

The Societe Electrique Westinghouse de Russie has nearly finished its work of electrifying certain horse-car lines in St. Petersburg. There have been rumors lately to the effect that the company has been fined for failure to complete parts of the work by specified dates. No such fine has been imposed. The company has been paid in instalments, amounting, so far, to $2,400,000. Of the remainder due, $88,000 has been reserved by the government as a contingent fine, but the company is confident that this penalty will not ultimately be imposed.

A. L. Whipple, Assistant Treasurer of the Curtain Supply Company, Chicago, has resigned, effective November 25, to become Second Vice-President of the Telharmonic Securities Company, with office at Broadway and 39th street, New York. This company is in charge of the finances of the Cahill Telharmonic Company of New York. This company's system of transmitting music electrically consists of a number of dynamos each generating such a current as will cause a resonator to give out a particular musical note. A keyboard controls the different circuits, so that by playing on the keyboard, music can be produced at the resonator. The company plans to have central stations in different cities. One is now in operation in New York and there are a number of subscribers to the service, the installation of resonators and the terms on which they are used being similar to that of telephone service. Mr. Whipple has been in the railroad supply business for fourteen years and with the Curtain Supply Company for nine years. He became interested in

the Telharmonic company last June while trying to have its music transmitted from New York to Atlantic City for the Master Car Builders' and Master Mechanics' conventions.

Iron and Steel.

Japanese railroads are in the market for 1,500 tons of light rails.

The Mexican government is said to have issued an order permitting the free entry of 6,000 tons of rails from Russia for lines being built by the Southern Pacific in Mexico.

OBITUARY NOTICES.

N. Staat, Assistant General Freight Agent of the Chicago, Indianapolis & Louisville, died on November 13 of appendicitis. Mr. Staat was 30 years old.

Jesse Newton Seale, Manager of the Northern and Eastern districts of the Southern, died on November 11. A few days before, he had a stroke of paralysis at Salisbury, N. C., and pneumonia developed while he was being taken to Washington. Mr. Seale was born in Mississippi in 1862. He went to school at the East Mississippi University at Columbus and began railroad work in 1875 as a messenger boy on the Mobile & Ohio. He worked as telegraph operator, agent and train despatcher until 1881, when he went to the Cincinnati Southern, where he was in the office of the General Manager. The next year he went to the Texas & Pacific as chief clerk to the Superintendent and in 1883 spent a few months in the Western Union Telegraph and the Associated Press at New Orleans. He then returned to railroad work as a train despatcher on the Southern Pacific and soon went to the Alabama Great Southern as chief despatcher. In 1886 he returned to the Mobile & Ohio, being made Trainmaster. Two years later he was appointed Assistant Superintendent, and in 1890 was made Superintendent at Jackson, Tenn. In 1899 he was appointed Superintendent of Transportation and three years later went to the Southern with the same title. He was later appointed Manager of Transportation, and in the spring of the present year was advanced to the office he held at the time of his death.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Canadian Society of Civil Engineers.

At a meeting of the mining section Nov. 21, a paper on "Chrome Iron Mining in Canada," by Henry F. Strangways, B.A., was read by the author.

Franklin Institute.

At the section meeting in Philadelphia November 21, a paper was presented by Dr. Allerton S. Cushman on the "Corrosion of Iron and Steel."

Railway Club of Pittsburgh.

At the meeting of this club in the Monongahela House, November 22, an address on "Car Wheels," illustrated by stereopticon views, will be given by George L. Fowler, of New York.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Ann Arbor.—See Detroit, Toledo & Ironton.

California Railroad Commission.—A. M. Wilson has resigned.

Corvallis & Eastern.—The authority of the following officers of the Oregon Railroad & Navigation has been extended over the Corvallis & Eastern: M. J. Buckley, General Superintendent; J. F. Graham, Superintendent of Motive Power; R. B. Miller, General Freight Agent; William McMurray, General Passenger Agent; R. Koehler, General Purchasing Agent, and G. W. Boschke, Chief Engineer.

Detroit, Toledo & Ironton.—George K. Lowell, General Manager, has been elected Vice-President of this company and of the Ann Arbor.

Oregon Railroad & Navigation.—See Corvallis & Eastern.

Pennsylvania.—The legal department has been reorganized, so that instead of a General Counsel, a General Solicitor and three Assistant General Solicitors, there are now a General Counsel with three assistants and a General Solicitor with two assistants. G. S. Patterson and P. B. Prince, heretofore Assistant General Solicitors, have been made Assistant General Counsels, the third being H. S. P. Nichols. S. B. Lloyd and H. W. Bickle have been appointed Assistant General Solicitors.

Toledo, St. Louis & Western.—The office of G. H. Ross, Second Vice-President and General Traffic Manager, has been moved from Toledo, Ohio, to Chicago.

Western Pacific.—J. D. Brown, Treasurer, has resigned.

Operating Officers.

Alabama Great Southern.—J. W. Evans, Master Mechanic, has been appointed Superintendent, with office at Birmingham, Ala., succeeding R. E. Boswell, resigned to go to the Seaboard Air Line.

Boston & Albany.—J. L. Truden has been appointed Acting Superintendent of the Albany division, with office at Springfield, Mass., succeeding to the duties of Charles Firth, who has been given leave of absence.

Chicago, Burlington & Quincy.—H. W. Hamm, Trainmaster at St. Joseph, Mo., has been appointed Superintendent at Centerville, Iowa, succeeding J. P. Boyle, resigned.

Chicago, Rock Island & Pacific.—E. S. Moore has been appointed Assistant Superintendent of Terminals at St. Louis, Mo.

International & Great Northern.—E. E. Johnson, Assistant Superintendent at Mart, Tex., has been appointed Superintendent at that place, succeeding C. J. Larimer, resigned to go to another company. J. D. Whittington succeeds Mr. Johnson.

Kansas City Southern.—J. P. Spivey, chief clerk to the Superintendent of Transportation, has been appointed Superintendent of Transportation, with office at Kansas City, Mo., succeeding F. S. Rawlins, resigned to go to the Northern Pacific.

Lehigh Valley.—J. N. Haines has been appointed Inspector of Transportation, succeeding G. B. Minshull, promoted.

Mexican Central.—C. T. Norton has been appointed Superintendent of the Coahuila & Pacific division, with office at Saltillo, Coahila, succeeding E. R. Walter, resigned to go to another company.

Oregon Short Line.—See Union Pacific.

St. Louis & San Francisco.—F. D. Hahnskeen has been appointed Trainmaster at Sapulpa, Ind. T.

Trinity & Brazos Valley.—F. J. Norris has been appointed Trainmaster of the Dallas and Fort Worth branches, with office at Teague, Tex. Patrick Owens remains Trainmaster of the rest of the road.

Union Pacific.—W. E. Whitney, Superintendent of the Denver union station, has been appointed Superintendent of a new division consisting of the Union Pacific line from Rawlins, Wyo., to Green River, now part of the Wyoming division, and the Oregon Short Line's road from Green River to Ogden, Utah. Mr. Whitney's headquarters are at Ogden.

Traffic Officers.

Canadian Pacific.—W. M. Kirkpatrick, General Freight Agent of the Atlantic division, has been appointed General Freight Agent of the Ontario division, with office at Toronto, Ont., in charge of through traffic. M. H. Brown remains General Freight Agent in charge of local traffic. H. E. McDonnell, General Freight Agent at Nelson, B. C., succeeds Mr. Kirkpatrick, with office at St. John, N. B. W. C. Bowles, Assistant General Freight Agent of the Pacific division, succeeds Mr. McDonnell. G. H. Smith, Assistant General Freight Agent of the Central division, succeeds Mr. Bowles, with office at Vancouver, B. C. W. H. Robertson succeeds Mr. Smith, with office at Winnipeg, Man.

Engineering and Rolling Stock Officers.

Alabama Great Southern.—See this company under Operating Officers.

Canadian Pacific.—A. L. Hertzberg, Engineer of Maintenance of Way, has been appointed Division Engineer of the Ontario division, with office at Toronto, Ont., succeeding J. M. R. Fairbairn, who has been appointed Division Engineer at Montreal, Que. The office of Engineer of Maintenance of Way has been abolished, and its duties will hereafter be performed by F. P. Gutelius, Assistant Chief Engineer.

Purchasing Agents.

Chicago & Eastern Illinois.—See Chicago, Rock Island & Pacific.

Chicago, Rock Island & Pacific.—J. M. McCarthy, chief clerk in the General Purchasing Agent's office, has been appointed General Purchasing Agent of this company and of the Evansville & Terre Haute and the Chicago & Eastern Illinois, effective December 1, succeeding F. P. Jeffries, resigned. M. E. Towner has been appointed Assistant to E. L. Pollock, Vice-President in charge of the purchasing department.

Evansville & Terre Haute.—See Chicago, Rock Island & Pacific.

Special Officers.

Pennsylvania.—R. H. Newbern, Assistant Superintendent of the insurance department, has been appointed Superintendent of that department, succeeding Hugh B. Ely, deceased.

LOCOMOTIVE BUILDING.

The State Railroads of Chili are in the market for 60 locomotives.

The Chicago & North-Western, it is said, is considering the purchase of 10 locomotives.

The Florida East Coast did not recently order 12 locomotives from the American Locomotive Co., as reported in the *Railroad Gazette* of November 8.

The Hocking Valley, according to press despatches, has reserved space with the American Locomotive Co. for 10 switching and two passenger locomotives for 1908 delivery.

The Pittsburgh, Shawmut & Northern has not ordered 10 freight locomotives and two passenger locomotives as reported in the *Railroad Gazette* of November 15, and it does not expect to do so this year.

The Denver & Rio Grande, as reported in the *Railroad Gazette* of November 1, has ordered 28 simple consolidation (2-8-0) locomotives from the American Locomotive Co., for January and February, 1908, delivery. The specifications are as follows:

General Dimensions.

Type of locomotive	Consolidation
Weight, total	220,000 lbs.
Weight on drivers	192,000 "
Diameter of drivers	57 in.
Cylinders	23 in x 28 in.
Boiler, type	Radial stay; extended wagon top
" working team presssure	200 lbs.
" number of tubes	364
" material of tubes	Charcoal iron
" diameter of tubes	2 in.
" length of tubes	15 ft.
Firebox, length	108 in.
" width	65¼ "
" material	Worth steel
" grate area	49 sq. ft.
Heating surface, total	3,028 "
Tank capacity	8,000 gals.
Coal capacity	14 tons

Special Equipment.

Air brakes	Westinghouse
Brake-beams	National-Hollow
Couplers	Tower
Injector	Simplex
Piston rod packings	Paxton-Mitchell
Valve rod packings	Paxton-Mitchell
Safety valve	Coale
Sanding devices	Hanlon
Sight-feed lubricators	Nathan
Springs	Railway Steel-Spring Co.
Tires, driving wheel	Midvale
Wheel centers	Standard Steel Co.

CAR BUILDING.

The Pere Marquette has asked bids on 1,000 box cars.

The Detroit, Toledo & Ironton has asked bids on box and flat cars.

The Canadian Pacific has been receiving bids on some 40-ton tank cars.

The Boston & Maine is said to be in the market for passenger equipment.

The Chicago, Rock Island & Pacific is asking prices on 30 miscellaneous cars.

The Chicago, Rock Island & Pacific has been asking bids on box, gondola and flat cars.

The Chicago, Indianapolis & Louisville has asked bids on several hundred box and gondola cars.

The Tonopah & Tidewater recently ordered three chair cars, one baggage car and one smoking car from the Pullman Company.

The Coney Island & Brooklyn has ordered 10 electric car bodies from the J. G. Brill Co., but the trucks and motors have not yet been decided on.

The Grand Trunk has decided not to order the 1,000 steel coal cars for which they recently asked bids, as reported in the *Railroad Gazette* of November 8.

The New York, Ontario & Western has postponed its proposed order for 10 passenger cars, on which it asked bids, as reported in the *Railroad Gazette* of October 18.

The Zanesville & Western, according to press despatches, has ordered 500 drop bottom coal cars of 100,000 lbs. capacity from the Ralston Steel Car Co., for December delivery.

The Virginian Railway, it is understood, will not for the present buy 100 coal cars, as reported in the *Railroad Gazette* of November 15, but it is said that the company will soon buy eight special cars.

The Mexican Railway, as reported in the *Railroad Gazette* of June 7, is considering the purchase of six chair cars, six first class coaches and six third class coaches, for which they were reported in the market.

RAILROAD STRUCTURES.

ISELIN, PA.—The Buffalo, Rochester & Pittsburgh has plans ready for a number of freight and passenger stations at important points on its Pittsburgh extension. The work is to be started this winter.

OTTAWA, ONT.—The Ottawa Electric Railway, it is said, will pay part of the cost of the proposed viaduct on the Richmond road.

ST. THOMAS, ONT.—The Michigan Central, it is said, has plans made for putting up a new roundhouse here.

VANCOUVER, B. C.—The British Columbia Electric Street Railroad has plans made for putting up a combined station and office building to cost $100,000. R. H. Sperling, General Superintendent.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALLEGHENY COAL RAILROAD.—Incorporated in West Virginia, with office at 1 Broadway, New York. The company proposes to build a line from the Baltimore & Ohio near Fairmont, W. Va., southwest through Marion, Harrison, Lewis and Gilmer counties to Glenville, 65 miles. The incorporators include Harry Smith, Baltimore; U. Hanmann, G. M. Dodge and A. Lerinsohn, of New York, and F. S. Landstreet, Davis, W. Va.

ASHCROFT, BAKERSVILLE & FORT GEORGE.—Application will be made at the next session of the Dominion Parliament for an extension of time to start work on this proposed line. The line is projected from Ashcroft, B. C., north to Fort George, about 300 miles. Eberts & Taylor, Vancouver, B. C., are the Attorneys. (March 15, p. 394.)

ATCHISON, TOPEKA & SANTA FE.—Although President Ripley recently announced that improvements to be made by this company were to be curtailed, according to reports from Texas, engineers are still at work on final surveys for the proposed cut-off to be built from Brownwood, Tex., northwest to Texico, N. Mex., about 300 miles. (March 15, p. 379.)

BALLINGER & ABILENE.—This company, it is said, will let contracts this year for building its proposed line from Ballinger, Tex., north to Abilene, 55 miles. W. J. McDaniel, Chief Engineer, Ballinger.

BATON ROUGE, HAMMOND & EASTERN.—See Illinois Central.

BILLINGS & NORTHERN.—See Great Northern.

BRANDON, SASKATCHEWAN & HUDSON'S BAY.—See Great Northern.

CANADIAN NORTHERN.—This company, it is said, has graded 30 miles on a line which is projected from Saskatoon, Sask., southwest to Calgary, about 300 miles. This line is eventually to form part of a through line between Calgary and Ft. Churchill on Hudson Bay. Connection is also to be made with the line under construction north from Etiomani, Sask.

CANADIAN PACIFIC.—Officials of this company at Vancouver are reported as saying that bids will at once be asked for clearing and grading 48 miles of the Esquimault & Nanaimo extension from Nanaimo, B. C., west to Alberni. (Aug. 30, p. 247.)

Surveys are reported being made to extend the Manitoba & Northwestern from Sheho, Sask., northwest to Quill Lake, approximately, 62 miles.

CHICAGO & SOUTHERN TRACTION.—This company, it is said, recently finished an extension of its road and the line is now in operation from Chicago, Ill., south to Kankakee, 65 miles. The line is eventually to be extended southwest to Indianapolis, Ind.

CHICAGO, BURLINGTON & QUINCY.—An officer writes in reference to the proposed line from Frannie, Wyo., northwest, to Fromburg, Mont., 35 miles, that some surveys have been made, but there is no immediate prospect of the company building the line. (Nov. 8, p. 572.)

CROW'S NEST SOUTHERN.—See Great Northern.

CUMBERLAND RIVER & NASHVILLE.—Rights of way have been secured and work, it is said, will at once be begun by the Monticello Construction Co., of which J. H. Shearer is President, for building the section of this proposed line from Toteville, Ky., on the Cincinnati, New Orleans & Texas Pacific, southwest to a point 15 miles beyond Monticello. The line is to run from Corbin, Ky., southwest to Nashville, Tenn., 160 miles. (April 19, p. 564.)

DAKOTA & GREAT NORTHERN.—See Great Northern.

DENVER & RIO GRANDE.—The work of double-tracking the Eagle River Canyon on the main line of this road, just west of Leadville, Colo., is finished. The contractors, the Phillips Construction Company and O'Gara, commenced work about a year ago. The new second track, built through the narrow canyon, cost more than $100,000 a mile to construct. In the five miles there are three tunnels, with a total length of 800 feet, being 100, 300 and 400 feet, respectively. There are five steel bridges with solid concrete floors, The new line, which is to be used for the eastbound or uphill haul, reduces the grade from 3.3 per cent. to 2.3 per cent., and the curvature is also greatly lessened.

ERIE, LONDON & TILSONBURG (ELECTRIC).—This company is applying for an extension of time for the construction of its line already authorized. The projected route is from Port Burwell, Ont., northwest to London, 40 miles, with a branch east to Tilsonburg, 15 miles. (March 15, p. 395.)

ESQUIMAULT & NANAIMO.—See Canadian Pacific.

GREAT NORTHERN.—The report of this company for the year ended June 30, 1907, shows that during the year the Dakota & Great Northern from Aneta, N. Dak., northwest to Devils Lake, 57.72 miles, was opened for traffic; also an extension from Thorne, N. Dak., northwest to Dunseith, 7.61 miles, and the extension from Berthold, N. Dak., northwest to Crosby, 89.09 miles. The line from Walhalla, N. Dak., north to the International boundary, 5.35 miles, where connection is to be made with the Midland of Manitoba, is to be opened this fall. The Billings & Northern from Armington, Mont., southeast to Laurel, 194.29 miles, has grading about two-thirds finished, and tracklaying was started last May. Up to June 30, 17 miles of track had been laid.

The Brandon, Saskatchewan & Hudson's Bay from the international boundary north of St. John, N. Dak., north to Brandon, Man., 69.45 miles, has been opened for traffic. The Midland of Manitoba from the international boundary north of Neche, N. Dak., northwest to Portage la Prairie, Man., 77.01 miles, has been opened for traffic, and the line from the international boundary north of Walhalla, N. Dak., to Morden, Man., 15.54 miles, is to be opened this fall.

The Vancouver, Victoria & Eastern and the Washington & Great Northern have been opened for operation from Midway, B. C., to the international boundary near Molson, Wash. (V., V. & E.), 28.89 miles, and from the international boundary near Molson to Oroville, Wash. (W. & G. N.), 27.82 miles. On the section from Oroville west to the international boundary at Chopaka (W. & G. N.), 20.64 miles, and from that place to Keremeos, B. C. (V., V. & E.), 18.20 miles, tracklaying has been finished. The V., V. & E. is also building from the Pacific coast east to meet the line building west from Keremeos. On this section work is under way from Cloverdale, B. C., east to Abbotsford, 26.25 miles. The V., V. & E. and the Victoria Ferry & Railway Company is building a low-grade line from New Westminster, B. C., south to Blaine, Wash. The portion of the line from New Westminster to Olivers, 9.80 miles, is being built by the V., V & E., and from that place to the international boundary north of Blaine, 11.32 miles, is being built by the V., F. & R.

Work is under way on the Crow's Nest Southern, building a 24-mile extension from Fernie, B. C., north to the mines of the Crow's Nest Pass Coal Company at Michel, B. C.

To facilitate the handling of iron ore, a line has been built from Kelly Lake, Mich., southeast to Fermoy, 23.40 miles, which was opened for traffic in September. An extension 1.67 miles long of the Stevenson mine spur has been finished. The company also built from Neche, N. Dak., .64 miles, to a connection with the Midland of Manitoba at the international boundary. A new line from Schurmeier, N. Dak., south to Grand Forks, permitting the abandonment of the old line between these places and giving a more direct connection with the new yards at Grand Forks, was built. The extension of the Brown's Valley branch in Minnesota to Lake Traverse, 1.92 miles, was put in operation last year.

The following work has been finished or is nearing completion: New terminals, including buildings and six miles of yard tracks, at Casselton, N. Dak.; similar work, including 11 miles of yard tracks, at Devils Lake, N. Dak.; also at Grand Forks, including 10 miles of yard tracks, and a 25-stall engine house at St. Paul, Minn. Grade reduction work between Minneapolis, Minn., via Wayzata, Willmar and Breckenbridge to Aneta, N. Dak. A number of smaller stations and buildings were also put up during the year. About three miles of sea wall has been built, and 4½ miles of double-track laid between Everett, Wash., and Seattle. The net increase in side track mileage during the year, not including the tracks on new lines under construction, or opened for operation during the year, was 132.13 miles. In addition 6.44 miles of side tracks were laid in connection with the Seattle passenger station, and track material for 10 miles of extensions to logging spurs near Solway and Akeley, Minn., were furnished by the company. During the year the main tracks were relaid with 85-lb. rails on 377.86 miles, and with 70-lb. rails on 45.87 miles. Several changes in the location of lines at various points have been made to improve the alinement, aggregating 9.41 miles. During the year the company replaced wooden and iron bridges and trestles with steel bridges, aggregating 3,667 ft., and 5,429 ft. of fills. Some of the work now in progress includes: Second main track between Devils Lake, N. Dak., and Churchill's Ferry, between Everett, Wash., and Ballard, the latter including the completion of the sea wall. The erection of terminal buildings and enlargement of yards at Kelley Lake, Minn., and at Allouez, Wis. A new yard is being built on the bay front, Superior, Wis., for coal traffic, preparatory to building a new elevated line for an entrance into Duluth, Minn., over the Duluth and Superior bridge controlled by the company. A change of line at Albany, Falls, Idaho, includes putting up a new steel bridge over the Pend d'Oreille river. A new dock and grain warehouse are also to be put up at Everett, Wash., and timber bridges are to be replaced with steel structures aggregating 2,900 ft.

HIDALGO & NORTHEASTERN.—See National of Mexico.

ILLINOIS CENTRAL.—A statement is made that the present plans for the construction of the Baton Rouge, Hammond & Eastern projected from Baton Rouge, La., east to Merrill, Miss., about 170 miles, call for building the line from Baton Rouge east to Covington, 65 miles, as rapidly as the work can be done. East of that place there will be nothing done at present. (June 14, p. 878.)

ILLINOIS TRACTION.—The St. Louis & Staunton has been incorporated, with office at Champaign, Ill., to build a line from the main line of the Illinois Traction at Edwardsville, Madison county, northeast to Staunton, Macoupin county, 20 miles. The St. Louis & Northeastern, a subsidiary of the Illinois Traction, now operates a line between these places. The incorporators include: G. N. Mattis, W. H. Carnahan, R. H. Watson, Jr., B. M. Bramble and C. Zille.

LEHIGH & LAKE ERIE.—See Lehigh Valley.

LEHIGH VALLEY.—The Lehigh & Lake Erie, a 10-mile double-track terminal line in Buffalo, is finished. The line has not yet been opened for traffic.

MANITOBA & NORTHWESTERN.—See Canadian Pacific.

MEXICAN CENTRAL.—Work is under way on the Manzanillo extension, repairing the damage caused by floods last summer. About 10 miles of grade and track were washed away.

MIDLAND OF MANITOBA.—See Great Northern.

MISSOURI PACIFIC.—Contracts are reported let to L. J. Smith, of Kansas City, Mo., at $1,500,000, for ballasting with gravel the tracks of the St. Louis, Iron Mountain & Southern in Arkansas and Louisiana. It will require eight months to finish the work.

NATIONAL OF MEXICO.—Plans, it is said, have been made to extend the Hidalgo & Northeastern from Beristain, Hidalgo, northeast to the port of Tuxpan, on the Gulf coast, about 125 miles. It is said that the Government will carry out extensive improvements to make a deepwater harbor at Tuxpan.

NEW YORK CENTRAL & HUDSON RIVER.—The New York State Public Service Commission, First district, has begun legal action to condemn the rights of this company on Eleventh avenue in New York City. This is in pursuance of the law under which the company's tracks in Eleventh avenue, used mostly for freight, will have to be taken up and rebuilt either above or below the surface.

NEW YORK & STAMFORD (ELECTRIC).—This company, which operates a 16½-mile electric line from New Rochelle, N. Y., northeast to the Connecticut state line, has been granted permission to double-track its line in Larchmont, Rye and Portchester.

NORTHERN PACIFIC.—It is expected that this company will soon let contracts for piercing a tunnel from the Narrows to the water front in Tacoma, Wash. When this work is begun, it is said, contracts will be let for the new $500,000 passenger station.

ONTARIO ROADS (ELECTRIC).—A franchise has been granted to build an electric line from Cobalt, Ont., north to Haileyburg, about five miles. The line is eventually to run south from Cobalt to the Silver Queen mine and north from Haileyburg to New Liskeard. Judge C. M. Stone, of Cleveland, Ohio; M. J. O'Brien, R. J. Fitzpatrick and Frank Latchford, of Ottawa, Ont., and T. Fitzpatrick, of New Liskeard, are interested.

OREGON & WASHINGTON.—See Union Pacific.

OREGON RAILROAD & NAVIGATION COMPANY.—See Union Pacific.

OREGON SHORT LINE.—See Union Pacific.

PHILADELPHIA & READING.—Bids are wanted December 17 at the office of W. Hunter, Chief Engineer, Philadelphia, for grade crossing elimination work on the Philadelphia, Germantown & Norristown, as follows:

Contract No. 5.—Masonry, trestle and embankments from south side of Berks street to the south side of Susquehanna avenue.

Contract No. 7.—Similar work from south side of Susquehanna avenue to Broad street.

Contract No. 8.—Bridges from Berks street to Broad street.

Contract No. 14.—Masonry, embankment and paving for yards between York street and Cumberland street.

Contract No. 26.—Temporary engine yard at Wayne Junction.

St. Louis & Staunton.—See Illinois Traction.

St. Louis, Iron Mountain & Southern.—See Missouri Pacific.

San Antonio & Aransas Pass.—Plans are reported being made by this company to lay heavier rails on its road from San Antonio, Tex., east to Houston, 239 miles.

Southern Utah.—This company, it is reported, will soon let contracts for building its proposed line from Price, Utah, on the Rio Grande Western south about 20 miles to Miller creek. L. P. Elliott, Chief Engineer, Salt Lake City.

Texas City Terminal.—H. B. Moore, General Manager of this company, is quoted as saying that in the last year the railroad built four miles of track to a connection with the Gulf, Colorado & Santa Fe, and also built six miles additional, for increasing the terminal facilities at Texas City. The road now has connection with all lines entering Houston from Galveston.

Tuscarawas Valley Transit & Power Co.—Under this name a company proposes to build a line from Canal Dover, Ohio, north via Zoar and Bolivar to Canton, about 25 miles. The line may eventually be extended from the proposed southern end at Canal Dover southwest via Coshocton to Columbus. The promoters' names are not given.

Union Pacific.—This company recently opened a new branch to coal mines on its Colorado division at St. Vrain which may eventually be extended north to Fort Collins. Double-tracking work is in progress on a large section of the road through Nebraska and Wyoming. The double-track in operation and on which work is under way is shown in the following table:

	Tracks		
	Double, in operation.	Second, under construction.	Single.
Council Bluffs, Iowa, to 13th St., Omaha	3.1	.....	.....
Add'l tracks, 13th St. to Omaha city limits	.....	2.0	.....
S. O. & W. R. R.	.....	11.6	.....
Lane to Valley	11.3	.....	.....
Valley to Benton	.....	48.9	.....
Benton to Columbus	7.9	.....	.....
Columbus to Silver Creek	.....	17.5	.....
Silver Creek to Lockwood	.....	38.5	.....
Lockwood through Grand Island to Alda	13.7	.....	.....
Alda to Buda	.....	29.8	.....
Buda through Kearney to Watson's Ranch	10.1	.....	.....
Watson's Ranch, Neb., to Archer, Wyo.	.....	.....	36.7
Archer to Buford	35.3	.....	.....
Buford to Hermosa	.....	.....	11.9
Hermosa to Laramie	17.9	.....	.....
Laramie to Lookout	.....	.....	27.6
Lookout to Hanna	49.3	.....	.....
Hanna to Rawlins	.....	.....	39.9
Rawlins to Wamsutter	.....	41.4	.....
Wamsutter to Point of Rocks	.....	.....	52.9
Point of Rocks to Rock Springs	26.2	.....	.....
Rock Springs to Green River	.....	.....	13.9
Total	174.8	189.7	182.9

The Oregon Short Line is making improvements in Salt Lake City to cost $1,800,000. About 25 miles of sidings, a freight house 600 ft. long, and a passenger station to cost $300,000 are being built. A new branch is projected from Sugar, Idaho, on the Yellowstone Park branch southeast to coal fields at Victor, below the South Fork river, about 50 miles. Work is also under way building a branch from Huntington, Ore., at the junction of the Oregon Railroad & Navigation Co.'s line, north along the Oregon-Idaho state line, following the Snake river, to be built eventually to Lewiston, Idaho. This line will probably form part of a through transcontinental line; 59 miles of the line has been authorized and grading is finished for 25 miles. (Oct. 4, p. 403.)

The Oregon Railroad & Navigation Company is extending its branch from Elgin, Ore., east to Joseph, 63 miles. From The Dalles, Ore., west to Portland, 88 miles, the company has been at work for the past year reducing the heavy grades and the worst curves and improving the track; about $1,500,000 is now being spent on this work. The longest stretch of straight track between The Dalles and Portland on the present line is about two miles. On one of the improvements now under way, that between Troutdale and Bonneville, 17.48 miles, the reduction in curvature will amount to 1,454 deg. 51 min. The amount of bridging is also being greatly reduced between The Dalles and Portland, where five years ago there were 7½ miles of bridges there is now but about half a mile. Terminals have been bought at a cost of about $20,000,000 and a considerable amount of the right-of-way has been secured for the proposed Oregon & Washington, projected from Portland, Ore., north to Tacoma and Seattle, about 230 miles. This line will cost about $15,000,000. Announcement is made that work is to be begun next month at Tacoma, Wash., on an 8,700-ft. tunnel to have two tracks for this line. The cost of the tunnel will be about $3,000,000. (Nov. 15, p. 665.)

Announcement is made that this company will build a 20-mile branch from Rock Springs, Wyo., north to extensive coal fields. There are also to be three or four laterals, with a combined length of about six miles.

Vancouver, Victoria & Eastern.—See Great Northern.

Victoria Ferry & Railway Company.—See Great Northern.

Washington & Great Northern.—See Great Northern.

West Side Belt.—Work has been started by this company, rebuilding the Banksville branch, which is to be extended later to Washington county, where the Gould interests own extensive coal lands. The rebuilding of this line is thought to be the first step toward the development of the Washington county property.

RAILROAD CORPORATION NEWS.

Atlantic Coast Line.—The Directors have decided not to take action on the annual dividend on the common stock until some time in December, when a special meeting will be called. The company has been paying 6 per cent. on its $47,537,600 common stock for the last two years.

The New York Stock Exchange has listed $383,000 additional first consolidated mortgage 50-year 4 per cent. bonds, making the total listed $43,524,000. The additional bonds were sold to pay for new rolling stock.

Boston & Maine.—Gross earnings for the three months ended September 30, 1907, were $11,607,602, an increase of $388,446; net earnings $3,541,722, an increase of $188,287. The surplus after charges was $1,293,507, a decrease of $141,007.

Chicago, Indianapolis & Louisville.—Millett, Roe & Hagen, New York, are offering at 111 and interest $50,000 refunding mortgage 6 per cent. bonds of 1947, being part of an outstanding issue of $4,700,000. This offering of an underlying long term bond secured by a direct mortgage lien at a price to yield 5.35 per cent. is an illustration of the present low prices for railroad securities. These bonds sold at from 128 to 137 in 1906.

Chicago Union Traction.—A modified plan of reorganization has been approved by Judge P. S. Grosscup and Professor J. C. Gray and the reorganization committee has asked the holders of the securities of the different street railway companies in Chicago to deposit their holdings on or before November 25 under the terms of the new plan.

Illinois Central.—To President Harahan's circular letter mentioned in this column last week, Stuyvesant Fish replies that the fact that the personnel of the management has so far not been changed and is considered efficient is gratifying to him, since these appointments were made under his administration. He says that he is making the contest not because the present condition of the Illinois Central is alarming, but because he believes that domination by the Harriman interests will result in future changes which will hurt Illinois Central stockholders.

Mexican Railway.—Gross earnings for the six months ended June 30, 1907, were $1,986,162, an increase of $237,833; net earnings, $870,594, an increase of $58,782. Net income, after charges, was $635,801.

Pere Marquette.—The meeting to approve the reorganization plan has been postponed to December 9. (Nov. 8, p. 574.)

Pontiac, Oxford & Northern.—The sale of this road under foreclosure has been ordered by the Circuit Court, but pending an appeal to the Supreme Court no date for the sale has been set. The road runs from Pontiac, Mich., to Caseville, 100 miles, and has been in the hands of a receiver since March, 1905.

Southern Pacific.—Gross earnings for the three months ended September 30, 1907, were $34,254,658, an increase of $5,740,151; net earnings, after taxes, $10,062,657, a decrease of $743,623.

Tampa Electric.—This company has declared a semi-annual dividend of 2 per cent. on its $1,700,000 capital stock. The annual rate had been 10 per cent. for several years. The company owns all the street railways, 36 miles, and electric lighting plants in Tampa, Fla., and Port Tampa.

Union Pacific.—Gross earnings for the three months ended September 30, 1907, were $21,192,742, an increase of $2,493,242; net earnings, after taxes, $8,415,452, a decrease of $898,236.

Wabash.—The New York Stock Exchange has listed $416,000 additional first refunding and extension 50-year 4 per cent. bonds, making the total listed $24,366,000. These additional bonds were issued in exchange for debenture "B" bonds and the Stock Exchange has authorized the listing of $584,000 more as issued from time to time in exchange for debenture "A" and "B" bonds up to July 1, 1908.

York Railways Company.—The Governor of Pennsylvania has approved the merger of the electric railways in York county under the name York Railways Company. The new company will have $5,000,000 capital stock and will assume $3,431,000 bonds of the old companies. W. F. B. Stewart, York, Pa., is President.